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CLEVELAND, O., APRIL 30, 1891.

THE WEEK IN IRON CIRCLES.

General Features. A comprehensive view of the industries drawing upon pig iron stocks shows that, while agricultural works are very busy, car works and such shops as depend largely upon railroads for orders are generally slack. Rolling mills are turning out about two-thirds of their normal product, while in foundry lines nearly all melters of iron expect a better business further along in the year. The general situation continues hopeful. Two weeks of warm settled weather have put Spring work well forward. The acreage of crops will be very large under the stimulus of high prices. Railroad traffic is maintained better than was expected, and increase of earnings is general. Some veteran observers believe that we are in the very worst of the depression, and that a reaction cannot be much longer delayed. Others again fail to see daylight ahead. The conspicuous feature of the Detroit market, during the past week, has been the gravity of the labor situation. The iron business in that city has been in a state of decided uncertainty, owing to the street car strike having been assisted by the operators of nearly all of the foundries in this city. At this writing the large car manufactories have a strike upon their hands, and it is uncertain, indeed, when these matters may be adjusted and satisfactorily settled, certainly not until some time after May 1st. There is some inquiry for Lake Superior charcoal, from various parts of the country, and in some considerable amounts, which will probably result in the placing during the next ten days or two weeks of a considerable tonnage, and it is hoped, relieve the pressure of large stocks now in the hands of the furnacemen. Several additional sales of large size have been made in the Chicago market, of Lake Superior charcoal on basis of prices reported a week ago. It has been claimed by various parties that figures of $16.75, Chicago, have been made covering deliveries during last six months of the present year. The explanation of these exceedingly low prices is, that several furnaces of this class have piled up heavy stocks and have reached the point where they have been obliged to unload. A number of the leading companies, however, have declined to meet prices quoted, preferring to hold their metal indefinitely and take chances on better prices later in the Summer. Two or three stacks have blown out already in consequence of low market, and a number of others are certain to stop unless prices materially improve. It is evident that the low figures now being named on certain brands cannot long exist, and large consumers in the Chicago district realizing this, are anticipating their wants and buying part of their stock much ahead of their usual time. Local coke irons continue active and some good-sized sales are reported in this direction. Southern coke brands remain quiet and are held at unchanged figures. The feeling is generally gaining ground that market has touched bottom as to prices, and that an improvement will occur as soon as the usual Spring and Summer buying becomes general. The Louisville pig iron market is one of undoubted dullness, but very few sales have been made, and there is but little inquiry. Consumers report a scarcity of work. There is very little iron in the hands of Southern furnaces, old orders, and the few being taken from time, about keeping pace with the production of those in blast; $10.25 Birmingham, for grey forge, seems to be the nominal quotation, though sales are reported at less than $10. Although it cannot be said that there has been any radical change of feeling among consumers of pig iron in the territory tributary to Buffalo during the past few days, yet there certainly is to be seen a returning confidence. It is difficult to tell why this is so, but as the conditions of the market are practically unchanged, it is only fair to assume that it is due to a better outlook for trade. The general run of buying still continues to be of a hand-to-mouth character, indicating small stocks in foundry yards. Careful investigation confirms this theory. It has been quite common of late to find large foundries without more than ten days' supply of pig iron on hand, where formerly the same foundries carried from 500 to 1,000 tons as a reserve. At Cincinnati it is noted that there has been a little weakening in Southern mill irons, but values are well maintained in foundry grades. An occasional transaction is reported where the object was to realize prompt cash for a round lot of iron, and this has been at a concession. Charcoal iron values have declined under the long period of dullness.

The Local Situation. Despite the advance of the season, there appears to be no manner of change in the situation, and the trade is as flat and dull as it has been at any time since this downward movement began. The question that puzzles the ore interests as well as the pig iron makers, is the problematical disposition of the ore now on hand. It must be remembered that the ore brought down last season will suffice to supply most of the furnaces for five or six months. This ore, to be sure, was bought at a rate averaging a dollar more than it would bring to-day, if there were a market, and the furnacemen have written off this dollar when they made their last inventories. The fact of writing off this amount does not, of course, lessen the loss, but it assists in computing the cost of making iron on the basis of the 1891 prices. This ore the furnacemen are more than anxious to turn into cash, if they could do so without the loss of another dollar. If they could but get out even, if they could get a new dollar for an old dollar, the great majority would be satisfied to wait for better times, if it took a year. As it is, their money is locked up in iron ore, eating up interest, and there is as little prospect as ever of an early conversion of this raw material into cash. The coke strike, while nominally over, is still in force as far as the coke supply is concerned, and it is doubtful whether at this writing there is being made more than ten per cent. of the capacity of the entire region. In fact, outside of the Rainey ovens, the production does not exceed thirty cars a day, while a thousand cars a day is the capacity of the entire district. Quite naturally, of all the coke made by the Frick ovens, every pound will go to supply the Carnegie works until they are fully supplied, and after that the Illinois Steel Company is to be stocked up in the same fashion. Thus it follows, that the furnacemen hereabouts, no matter how badly some of them are desirous of starting up, will be in no position to do so, owing to a lack of coke at any price. The chances are very good, on the other hand, of the ability of the coke producers, when they do start up to make a full supply, to ask the same outrageously high price that prevailed before the strike, despite the reduction of wages they brought about. If, when all has been said, there are furnacemen still anxious to go into business again, they will have to face not only a market that apparently has no use for pig iron, or its products, but they will have staring them in the face a supply of ore that cost them a dollar a ton more than it is invoiced at, while coke and rail freights are to be maintained at the present notch. If this situation contains anything attractive for them, they will probably endeavor to start up as soon as possible; but in the opinion of a great many iron makers it would be unwise in the extreme to throw good money after bad, and to attempt to make iron with the present cost of production, when Bessemer is selling at $16, cash, in the valley, with an all-ore No. 2 foundry, scarce in supply, going at $15. It may be far better to lose the interest on the ore investments, than to attempt a re-imbursement on that score, by way of trebling the loss.

OUR CONSUMPTION OF IRON ORE IN 1890.

Eighteen million gross tons of iron ore were consumed in the United States during 1890! This, according to the estimates of the American Iron and Steel Association, just published. Translated into an object lesson, that means 1,200,000 car loads of fifteen tons each. Made up into trains of thirty cars each, it would give 40,000 trains. Allowing five trains to the mile, including motive power, we have 8,000 miles, or one-third the distance around the globe.

Of the 18,000,000 tons consumed, 1,246,830 tons were imported; this quantity subtracted from the quantity consumed, leaves 16,753,170 tons as the consumption of domestic ore in 1890, against 14,096,427 tons which entered into consumption in 1889, 12,062,530 tons in 1888, 11,300,000 tons in 1887, and 10,000,000 tons in 1886.

As emphatically shown by the statistics collected by *The Iron Trade Review* last December, the quantity of iron ore mined in 1890 must have been much in excess of that consumed, nearly 4,000,000 tons being on dock at Lake Erie ports alone at the close of navigation. We cannot venture an estimate of the total production of iron mines in 1890, but from the above showing, it could not have been less than 22,000,000 tons.

As usual, the Lake Superior mines furnished a very large proportion of the domestic production of iron ore. If we place the domestic production at 22,000,000, the Lake Superior region furnished 9,012,379 tons, or a little less than one-half. While other iron-producing districts showed very little increase in 1890 over 1889, notwithstanding the great demand for ore, the Lake Superior districts came up with an increase of 1,719,625 tons on shipments alone.

Figures are at hand to account for about one-half of the total shipments of iron ore in 1890, from which we take the following: Lake Superior mines of Michigan and Wisconsin, 8,132,115 tons; Vermilion Lake mines, of Minnesota, 880,264; Missouri mines, 188,653 (a very decided falling off from 1889, when 233,784 tons were produced); Cornwall mines, of Pennsylvania, 686,302 (a decrease of nearly 100,000 tons); New Jersey mines, 477,289; Chateaugay mines, near Lake Champlain, New York, 130,398; Crown Point mines, New York, 78,737; Port Henry mines, New York, 417,810; other Lake Champlain mines, 35,000; Hudson River Ore and Iron Company, New York, 72,505; Tilly Foster mines, New York, 76,949; Forest of Dean mines, New York, 23,016; Salisbury region, Connecticut, 26,058; Cranberry mines, North Carolina, 22,873 (an increase of 10,000 tons over 1889); Tennessee Coal, Iron and Railroad Company's Inman mines, 119,402; Allegheny County, Virginia, 184,640; Calhoun, Etowah and Shelby Counties, Alabama, 212,540 tons; total of above districts, 11,764,551 tons.

Interesting in connection with the above figures, is the fact that, notwithstanding the known production of Eastern mines amounted to about 2,000,000 tons, the Eastern furnaces called upon the Lake Superior regions for 680,000 tons of ore, a very large increase over previous years.

Of the 1,246,830 tons of iron ore imported in 1890 (the largest in our history), 362,068 tons came from Cuba. Importations from this source will be very largely increased in 1891. Aside from Cuba, our imports of iron ore come principally from Spain, Elba, Algeria and Greece. Canada has apparently dropped entirely out of the race.

SWEDEN STEPS INTO THE PROTECTION RANKS.

"That a wave of Protectionist feeling is overspreading the governments of leading Continental countries, is unmistakable," frankly admits the London *Iron and Coal Trades Review*. "Unfortunately," adds our contemporary, "this is so much the worse for our own [English] trade." "France," it goes on to say, "is exhibiting more clearly her hostility to Free Trade doctrines; Italy has done what she could to exclude British iron; Spain needs more money and favors increased import duties to raise it; and we need not say that German authorities take sides against the Free Traders." And now Sweden steps into the ranks of Protection countries.

The work of revising the duties was entrusted to the Tariff Commission, which has just reported to Parliament, recommending the imposition of higher import duties all round. The following are the principal changes proposed, as far as regards the iron and allied trades:

	Present duty.	Proposed duty.
Pig iron	free	$ 4.98 per ton
Rails	free	5.47 "
Tin-plates	free	16 20 "
Cast-iron tubes (including tubes for machinery)	free	4 05 "
Rolled tubes	free	10.81 "
Metal wire 1½ mm thick and above	$10 94	21 87 "
Copper plates, bolts, etc	free	.01 per lb.
Copper tubes and pipes	free	.02 "
Machinery, implements and tools	free	10% ad val.

Cutlery imports are rather heavily taxed already, but the duties are to be further raised, as are the duties on all kinds of cast iron goods, in accordance with the resolutions of the Parliament of 1888,

It is estimated that the new duties will effect an increase of $777,600 in the revenue, and it is difficult to see how the Swedish Parliament, with the examples of other Protectionist nations before them, can resist the logic of events sufficiently to defeat the proposed tariff. Of course, the first and chief sufferers will be English manufacturers.

KING PIG IRON.

Here are some facts regarding the pig iron production of 1890 in the United States worth preserving. They are grouped from the annual report of the American Iron and Steel Association.

Twenty-three States made pig iron in 1890. The solitary furnace in the new State of Washington, which was active in 1889 and immediately preceding years, was not in operation in 1890.

The total production in 1890 was 9,202,703 gross tons, against 7,603,642 tons in 1889, an increase of 1,599,061 tons, or over 21 per cent.

Our production of pig iron in 1890 was about 1,200,000 gross tons larger than that of Great Britain in the same year. *For the first time in our history we passed Great Britain in the race for supremacy.*

Pennsylvania produced almost 48 per cent. of the total production of 1890; Ohio, over 13 per cent; Alabama, almost 9 per cent., and Illinois, over 7 per cent. Every other State fell below 4 per cent.

The United States is also the largest producer of Bessemer pig iron in the world. In 1890 we produced 4,583,424 tons, against 3,529,584 tons in 1889.

Maine, Massachusetts and Connecticut alone made less pig iron in 1890 than in 1889.

Every Ohio district showed an increased production of pig iron in 1890, the Mahoning Valley advancing from 490,685 tons in 1889, to 555,261 tons in 1890.

Pennsylvania alone produced more than half as much pig iron as Great Britain.

STATISTICS OF THE AMERICAN IRON TRADE FOR 1890.

The Annual Statistical Report of the American Iron and Steel Association, for 1890, was delivered to the members on April 15, certainly showing great promptness on the part of General Manager James M. Swank. As usual, the report is replete with valuable figures regarding the iron and steel industry of the United States and foreign countries, and is a standing monument of the painstaking industry of Mr. Swank. We quote herewith the general review as given:

The year 1890 was all in all the year of greatest production in the history of the American iron trade. The production of pig iron was phenomenal in its magnitude, and the aggregate production of steel was much the largest we have ever attained. Consumption in all lines fully kept pace with production until just before the close of the year, when a financial panic of serious proportions, originating in London, in November, as a result of unwise investments in South American speculations, and speedily communicated to this country, suddenly checked the demand for iron and steel, and for many other manufactured products. In a little while there was a partial recovery from this sudden reaction, but during the months of November and December and the first three months of the present year, there has been a greatly reduced demand for pig iron, steel rails, and all other iron and steel products. There was an accumulation of pig iron stocks at the close of the year, and many furnaces were then blown out, while others have since been added to the idle list. The production of pig iron in the whole country during the first three months of the present year has been fully one-fifth less than the production in the last three months of 1890. In the steel rail trade during the first quarter of the present year there has been almost complete stagnation. Many rail mills have been entirely idle a large part of the time, while the production of others has fallen very far below their normal capacity. Railroad managers very generally declined during these months to place orders for rails, even for early delivery. The demand for manufactured iron and steel in miscellaneous forms has not been so seriously interrupted as the demand for pig iron and rails.

As these pages go to press in the early days of April there is not noticeable any marked improvement in the demand for pig iron. The stocks of unsold pig iron at the close of the old year have undoubtedly been reduced, but it is significant that prices have also been reduced since the opening of the new year. In the steel rail market there is a better outlook than existed a month ago. The purchase, in November last, of the Allegheny Bessemer steel rail plant by Mr. Carnegie and his partners, the consolidation early in March of the two large steel plants at Scranton, and the good understanding existing among all the steel rail manufacturers are influences which have combined to stiffen the prices of rails, so that railroad managers whose roads are in need of rails have nothing to gain by further delay in placing their orders. They are now placing them. The demand for iron and steel for structural purposes, particularly bridge building, continues fairly active, but current orders for locomotives and all kinds of railroad cars suffer greatly by comparison with the orders of a year ago.

The extraordinary character of the demand for pig iron in our country in 1890 was largely due to the increased demand for Bessemer steel, our production of which in that year was much larger than in any previous year, but it was also due in part to an increased demand for open-hearth steel, and to the

increased wants of foundries, machine shops and iron rolling mills. The demand for Bessemer steel rails was much more active in 1890 than in 1889, which will account for a part of the increased production of ingots, but there was also an increased demand for both Bessemer and open-hearth steel for various other purposes for which either or both are used—for bridges, ships, buildings, and other structural purposes; for plates, sheets, axles, springs, forgings, castings, machine tools, other tools, etc. There was a greatly increased demand in 1890 for iron and steel plates, and for iron and steel in other forms, to be used in the construction of iron and steel ships for the merchant service, and of steel ships and other vessels for the new American navy. Outside of the above demands there was an extraordinary demand for pig iron for all the purposes for which iron and steel are generally used, and for many new uses to which they have in late years been applied, such as the construction of electrical machinery and the equipment of the cable system of street-car lines. The locomotives, cars and car wheels required by our vast railroad system consumed in 1890 an immense quantity of pig iron and of the finished forms of iron or steel made from it. That the demand for domestic pig iron can not always be maintained at the same rate as that which prevailed in 1890 we already know, for production and consumption in 1891 are certain to be less than in 1890, but it may be regarded as also certain that our production in the years that are not far distant will more frequently exceed than fall below that of 1890. And the same prediction may safely be made of Bessemer and open hearth steel. We are pre-eminently an iron and steel consuming people, and our population is rapidly increasing.

The extraordinary production of iron and steel in this country in 1890 naturally called for a greatly increased supply of iron ore, coal and coke. The increased demand for iron ore and coke may be fairly measured by the increased production of pig iron and of rolled iron and steel. During the year the supply of natural gas for rolling mills and steel works failed in many places, and there was also from this cause an increased demand for raw coal, so that two influences combined to increase the demand for this raw material. There appears to be no doubt that the future supply of natural gas in this country for all purposes will be much less than it has been. The consumption of iron ore in the whole country in 1890 was probably about 18,000,000 gross tons. The shipments of Connellsville coke in 1890 amounted to 6,221,518 net tons; of Pocahontas Flat Top coke to 433,319 net tons.

The mileage of new railroad built in the United States in the last four years is reported to us by the publishers of Poor's *Manual* to have been as follows: 12,985 miles in 1887; 7,028 miles in 1888; 5,756 miles in 1889, and 6,344 miles in 1890. There were 588 more miles of track laid in 1890 than in 1889.

There never was such an active year in the building of locomotives in this country as 1890, the number built being much greater than in 1889. It has been ascertained that 16 firms built 1,860 locomotives in 1889, and that 14 firms built 2,213 locomotives in 1890. Other firms are known to have been very busy in the latter year. The number of locomotives built by the Baldwin Locomotive Works in 1889 was 827, which was regarded at the time as a remarkable achievement, but in 1890 the number built by these works was 947. The Schenectady Locomotive Works were the next largest builders in 1890, the number built in that year by these works being 337, which is said to have been an increase upon the number built in 1889 of 53 per cent.

As with locomotives, so also with iron and steel ships. We built more iron and steel ships for our merchant marine in 1890 than in any previous year, and the vessels built averaged a much larger tonnage than those built in previous years. The year 1889 was a year of large aggregate tonnage, but 1890 much exceeded it in both the number and tonnage of vessels built. The number of vessels built in the fiscal year 1889 was 48, while the number built in the fiscal year 1890 was 63. The largest number built in any fiscal year previous to 1889 was 48, in 1885. Many of the vessels built in 1889 and 1890 were built at ship-yards on the great lakes.

The year 1890 was an anomalous one for our iron and steel manufacturers in its relation to prices, as it was also for manufacturers of other products. The production and consumption of all leading articles of iron and steel, except steel rails, were not only much larger in 1890 than in any preceding year, but prices steadily receded from January to December. Many other manufactured products were produced and sold in exceptionally large quantities, but at declining prices. About the beginning of the year prices also began to decline in Europe. It has usually been the experience of manufacturers that prices fall with a decreased demand and rise when the demand increases. The experience of many American manufacturers in 1890 was of a precisely opposite character. Our explanation of the change is doubtless found in the fact that our productive capacity in all leading manufacturing industries is now so large that we are able to meet any extraordinary consumptive demands without creating that scarcity in supply which is essential to a rise in prices. The day for exciting booms in any American manufactured products seems to be over.

The season prices of Lake Superior iron ore which were established early in 1890 were maintained all through the year, except just before its close, when concessions were made on new contracts. Such contracts as have been made for the present season have been at prices fully $1 per ton below the prices ruling in 1890.

The price of Connellsville coke was advanced on November 1, 1889, from $1.50 to $1.75 per ton of 2,000 pounds, free on board cars at the ovens, which price continued to rule until February 10, 1890, when it was further advanced to $2.15 per ton. This price was maintained until the close of the year, but on the 1st of January, 1891, it was reduced to $1.90 per ton. On the 9th of February a general strike of Connellsville miners and coke workers interfered with further production until the present time and prices for such coke as could be obtained have not been uniform.

Although prices of iron and steel continued to shrink throughout 1890, no attempt was made to reduce wages until about the close of the year, when in some instances a reduction of about 10 per cent. was made. This action naturally followed after the occurence of the English panic and the business reaction early in November. Since the opening of the new year reductions previously made have been continued, and others have been made necessary by the increased dullness in trade.

There were few strikes or other difficulties in the iron trade or related industries during 1890. Toward the close of the year, however, two notable strikes for increased wages occurred. About the 1st of December several thousand coal miners and coke workers in Alabama demanded an advance in wages, which was refused and a general strike was ordered, which lasted until the middle of January, when the men returned to work at the old wages. During the strike many blast furnaces were banked or blown out. On the last day of the old year several hundred Hungarians and others employed at the Edgar Thomson blast furnaces struck for an increase in wages, which was refused, whereupon a riot was precipitated by the strikers on the 1st of January, who undertook to prevent other workmen from taking care of the furnaces. One innocent man was killed and others were seriously injured. Several of the furnaces were banked. In the end order was restored but wages were not advanced.

Since the beginning of the present year the most serious labor difficulty that has occured has been in the Connellsville coke region, where a general refusal by the miners to accept a reduction of 10 per cent. in their wages, coupled with a demand for an increase of 12½ per cent., resulted in a strike of 10,000 miners on the 9th of February, which was speedily followed by a strike of other miners and by the refusal of several thousand coke workers to longer work at the ovens. Nearly all the coke ovens in the district have since been idle, and as a consequence, the supply of coke for blast furnaces has been greatly curtailed, and many furnaces from this cause alone have been banked or blown out.

While the liquidations which have been made compulsory by the panic of last November are yet productive of much individual hardship, all signs indicate that the financial disturbances of six months ago have about spent their force.

SUMMARY OF THE FOREGOING STATISTICS FOR 1890.

We present below a complete summary of the foregoing statistics for 1890, in which year this country made the best record in the production of iron and steel that has ever been made by any country:

Production of pig iron, net tons	10,307,028
Production of spiegeleisen, included in pig iron, net tons	149,162
Production of bar, rod, hoop, skelp and shaped iron, net tons	2,208,880
Production of bar, rod, hoop, skelp and shaped steel, net tons	1,235,970
Production of iron and steel wire rods, included above, net tons	511,951
Production of plate and sheet iron, except nail plate, net tons	505,642
Production of plate and sheet steel, except nail plate, net tons	401,537
Production of iron cut nails, kegs of 100 pounds	1,206,130
Production of steel cut nails, kegs of 100 pounds	3,834,816
Total production of cut nails, kegs of 100 pounds	5,640,946
Production of iron and steel wire nails, kegs of 100 pounds	3,135,911
Production of all rolled iron, including iron nails and excluding rails, net tons	2,804,829
Production of all rolled steel, including steel nails and excluding rails, net tons	1,829,247
Production of Bessemer steel rails, net tons	2,091,978
Production of open-hearth steel rails, net tons	4,018
Production of iron rails, net tons	15,548
Total production of rails, net tons	2,111,544
Production of street rails, included above, net tons	110,353
Production of Bessemer steel ingots, net tons	4,131,535
Production of open-hearth steel ingots, net tons	574,820
Production of crucible steel ingots, net tons	79,716
Production of blister and "patented" steel, net tons	4,248
Production of all kinds of crude steel, net tons	4,790,319
Production of iron blooms, net tons	30,783
Value of imports of iron and steel	$44,540,084
Value of exports of iron and steel	$27,000,194
Imports of iron ore, gross tons	1,246,830
Domestic production of iron ore, gross tons	18,000,000
Shipments of anthracite coal from the mines, gross tons	35,855,175
Total domestic production of coal, gross tons	140,022,264
Iron and steel ships built in the fiscal year ended June 30th	63
Miles of new railroad completed	6,344
Total number of miles of railroad, December 31st	167,741
Immigrants in the calendar year ended December 31st	495,021

Protecting Structural Iron from Rust.

In an article in the *Railroad and Engineering Journal* on the preservation of iron and steel structural work, Mr. Woodruff Jones shows that asphalt, coal tar and iron oxide paints are all more or less unsuitable for this purpose and that pure red lead is the best material. With linseed oil, it forms a hard, elastic coating, clinging with great tenacity to the metal. It does not oxidize the iron as do the iron oxide paints, nor act as a carrier of oxygen from the atmosphere, and it does not soften and run when exposed to the hot sun, nor become brittle with age and scale off, as the asphalt and coal tar paints do. The Government has specified that the iron works of the new library building of Congress be protected with a coat of red lead, and the Navy Department has adopted it for the hulls of its iron and steel vessels, as direct experiment has proved that not only is the metal protected by it, but there is less fouling of the bottom of the vessel and fewer barnacles are found on surfaces thus protected. To obtain the best results with red lead, it must be applied to the work before it sets with the oil. If it be applied after the combining and settling process has taken place, the hard, clinging coating will not be formed on the iron surface. Red lead is more expensive in its first application than the other paints referred to, but it lasts longer and less labor is involved in repainting, so that it is cheaper in the long run.

Material for Car Wheels.

In a recently published account of the works of the Northern Railroad, of France, it is stated that they have an ingenious plan, in the interests of economy, of making wheels for cars by bending up seven pieces of bar iron in such a shape that the center fits inside a band or false felloe, which, in turn, is hammered into a groove in the tire. Felloe and bar are riveted together, and the bars bent round to the center of the wheel, and their ends then have a mold placed below them; cast iron is then run in forming the hub, which is afterward bored out and the cast steel axle forced in by 55,000 to 66,000 pounds hydraulic pressure. The life of the center of the wheel is said to be practically interminable under the ordinary conditions, and the cheapness is such that they are now adopted almost entirely.

BRITISH TRADE IN IRON AND STEEL.

The demand from the United States formed almost the solitary exception to the general falling off in takings of British iron and steel during March. A decrease in total takings amounting to 21 per cent., and in values to six per cent., is the burden of editorial complaint of leading English iron trade papers, and the large increase in demand from this country—41 per cent. over March, 1890—is, in consequence of its peculiar cause, rather a subject for regret than for satisfaction. This increase in tinplates is the chief cause of the rather small decline in values of exports to all countries, when compared with the heavy falling off in quantities exported. Far from this enlarged demand from the United States being looked on as a favorable feature, it is generally construed to indicate that with the going into effect of new tariff regulations on tinplate in this country in July, the present rush of English tinplates to this country will cease, and with this cessation the unfavorable balance, as compared with last year, will become still more pronounced. The general opinion seems to be that British trade as represented by the foreign demand for iron and steel is on the down grade, and one leading journal says that the March showing of exports was as bad as could well be.

The total exports of British iron and steel in March to all countries were 256,439 tons, against 324,721 tons in March, 1890. For three months the exports were 694 439 tons, against 904 534 tons in the first quarter of 1890, a decline of 23 per cent. The total value of the exports for the three months was $31 316,651, a decrease from the first three months of 1890 of 13 per cent. With the exception of the large gain in tinplates there have been few changes on the favorable side. Exports of bar, hoops and sheets and iron wire showed slight gains for the three months. Pig iron and railroad material showed heavy decreases, the latter due to decreased takings by the Argentine and British India. The continental demand for pig iron fell off very heavily. The exports to the United States for March and the three months compare with last year as follows:

	March		Three months	
	1891.	1890.	1891.	1890.
Pig	4,825	4,912	9,387	22,261
Bar	596	484	1,034	1,142
Railroad	2,423	741	2,428	1,815
Wire	270	330	752	809
Hoops and sheets	286	396	816	2,460
Tinplates	38,538	17,245	98,909	59,242
Cast and wrought	191	165	545	814
Old iron	2,317	1,386	4,869	4,756
Unwrought steel	2,915	1,367	5,275	4,109
Totals	52,467	37,026	124,015	97,399
Exclusive of tinplates	13,829	19,781	25,106	38,157

While the gain in the March total of exports to the United States is over 15 000 tons, or 41 per cent., the increase for the three months was only about 26 600 tons, or 27 per cent. Leaving out the item of tinplates it will be found that our takings of British iron and steel fell off 31 per cent. for the month and 34 per cent. for the three months. While pig iron, wire and hoop and sheet iron show small decreases, the gain in percentage of unwrought steel is very large, and the same is true of railroad material and old iron, but the small quantities of these goods involved make the gain in actual tons look small as compared with the gain of 21,400 tons, or 126 per cent., in tinplate shipments. For three months the shipments of tinplates gain 67 per cent., and unwrought steel 27 per cent. Railroad and old iron show smaller gains. Pig iron shipments fall off nearly 60 per cent., or to the extent of 12,874 tons, while bar iron, hoops and sheets, cast iron and wire fall off to lesser extents.

As throwing some light upon the condition of the English iron trade at home, the following from a leading London journal will be found of interest:

"The statistics published in connection with the pig and finished iron trades of the north of England are the only figures concerning those trades issued regularly and kept up to date, and, accepting them as a criterion of the condition of business in other parts, there is no ground for entertaining any other opinion than that trade has become very bad, and what is worse, it does not promise to improve soon; indeed, the general anticipation of even the most sanguine is that 'things will be worse before they are better.' The statistics of the pig iron trade for March are, to say the least, unsatisfactory. Trade is distinctly unfavorable, and what makes appearances worse is that the increase this year occurred at a time when so many furnaces had been blown out, and the production was at a smaller rate than it has been for a long time. It is naturally asked that if with a reduced output there is an increase of stocks in what should be one of the best shipping months of the year, what will be the state of affairs when the quiet Summer months arrive? There does not now appear to be much probability of an active Spring trade, for the inquiry is very small, trade is extremely bad abroad as it is in this country, and while stocks of foreign consumers are heavy, there is a plethora of native iron on which to draw. The figures we printed last week showed that our business with the continent this year so far had been unmistakably disappointing, being much below that of last year. Thus there is reason to believe that the export trade during the rest of the Spring will not come up to the average, and there does not promise to be much of a revival in business, at any rate before the Autumn trade sets in."—[Bradstreet's.

Union of German Manufacturers of Wood-Screws.

The *Koln. Volksztg.* brings the following: "The Union of the German Manufacturers of Wood Screws, a union of great importance, was taken very little notice of thus far. The Wood-Screw Union, embracing about six of the more important German and also English manufactories, enhanced a year and a half ago its prices by 50 per cent, because new material got dearer and—as it stated—on account of an enhancement in wages. It retains, up to date, its high prices although raw material has become much cheaper and the enhancement of wages has been inconsiderable only. It is easy to calculate what an enormous profit the wood-screw manufacturers realize from the home consumers, and, before all, from the ironmongers, and this circumstance gave rise to the conjecture whether also wood-screw manufacturers did not sell their products cheaper to foreign customers at the expense of the home consumers. Nothing definite has been found out so far. In a home bargain, however, the following case became known, apt to injure the repute of the union, not only in the export, but also in the home bargains. Bavarian artillery work-shops had asked for tenders for the supply of smaller working material, and the wood-screw works of Schwelm offered at 30 per cent. under the union prices; two firms of Munich—buying at union prices—had of course the worst of it. The union leans hereby on an exceptional regulation, not generally known within buying circles, according to which prices for submission of railways, military institutions and shipbuilding yards are reserved to the union, in order, in the contingency, to be able to meet foreign competition. But this is a different case altogether, the matter in question here is not a submission in the general sense, but simply a bargain of the consumer with a contractor to meet the necessary demand during one year at agreed upon prices. It is possible, that a want for some articles, given in delivery, does not take place at all, besides, a public submission never taken place, only firms, generally local ones, are invited to take the order. Such cases, however, carry uncertainty and disquietude into the trade. Therefore, consumers on a large scale are going to take steps to prevent any such future occurrences.—[Kuhlow's German Trade Review.

SOME OF THE TROUBLES WITH STEEL CASTINGS.

The causes of blowholes in steel castings are evidently numerous, if we are to believe all that is said about them. So far, the list is about as follows: (a) Piping action; that is, a shrinkage of the metal in cooling which causes it to be porous in the vicinity of the riser, and in other thick places. (b) Gases given off by the cores. (c) Gases in the steel itself. (d) Atmospheric air carried in by the liquid steel during pouring.

To prevent piping, cores properly located seem to be adequate. The location of the gate has much to do with it. Castings, which are otherwise the same, will be found porous in one cast and solid in another, where the location of the gate is different.

The main remedy for the blowholes due to gases and atmospheric air seems to be lowering the melting point, or the use of hot molds. The addition of aluminum to reduce the melting point is, owing to its low price, now being made the subject of extensive experiment, both here and in England. Some railroad companies in England, notably the Lancashire & Yorkshire, have been very successful in making steel guide yokes, truck wheels and driving wheels by the use of a "physic," as it is called, principally of aluminum. At the present time two scientific societies in England are investigating this matter. Lowering the melting point has the effect of allowing the steel to remain fluid a sufficient time to enable the gases given off by the cores, or which may be in the steel, or the atmospheric air that may be carried into the mold by the liquid steel, to escape through the veins provided. Much success has been attained in keeping the steel in a fluid state while in the mold, by using iron or steel molds coated with a thin layer of separating material, and cores as much as possible of iron, all of which are heated as high as practicable before the steel is poured.

It is evident from the progress recently made, and from the success already attained by some steel-casting companies in this country, that they will soon be able to produce sound steel castings of any form. In fact, there is little excuse now for steel castings so porous as to be objectionable for ordinary work. Of course, for receptacles to be kept tight under a heavy pressure, the small blowholes, which are at present almost unavoidable, will be found to be seriously objectionable; but so far as strength is concerned, these small blowholes matter but little. Stationary engine companies and makers of mining machinery are using large quantities of cast steel with numerous fine blowholes, and in their experience there seems to be no objection to such castings. In fact, it has been stated by them that even with a considerable porosity the castings of steel are more satisfactory and reliable than those of iron.

The cost of cast steel is lower than most people think. For instance, the large rolling mills make their own steel casting from the blooms from which they roll rolls, plates and beams, etc., and charge them up on their books at only two cents per pound, but such castings are large and rough. English railroads have found that for equal strength cast steel is cheaper than cast iron. The cost of melting steel is but little, if any, greater than melting cast iron when one is familiar with it. The possibilities in this way are well illustrated by a brake-shoe company in Chicago, which has recently put in a steel casting plant for brake shoes. They are now making their own cast steel without the least difficulty, and they get a more uniform product than they have been able to buy in the past. There are as many grades of cast steel as of cast iron, and, just as some foundries make good cast iron while others make only an inferior casting, so some cast steel makers are sending out cast steel which is not as good as first-class cylinder iron, while others are making a very good product. There is a knack in this business, as in every other; but the demand for cast steel is such, both here and abroad, as to make the subject interesting to scientific investigators, and we may hope to learn within a year or two of rapid improvements in the processes for making cheap steel castings.—[Railroad Gazette.

Nickel Steel.

It is probable that a new industry will in a little while be carried on in Sheffield or in the immediate neighborhood. This is the production of ferro-nickel in a form suitable for use in the production of what will be known as nickel steel. Some time ago Mr. J. F. Hall, of Messrs. Wm. Jessop & Sons (Limited), took out a patent for the use of nickel in the making of steel, and an armor plate of his, in the making of which nickel played an important part, underwent a successful trial at Portsmouth. Since then a syndicate, of which he is a member, has been formed to purchase the rights of other patentees in France and America, and to obtain the control of supplies of nickel ore.—[Glasgow Engineer.

LAKE SUPERIOR MINING NOTES.

GOGEBIC RANGE.

The body of ore reached from the new No. 4 shaft at the Anvil is developing into something pleasing to its owners, and will give the mine the greatest impetus it has yet had in its stride towards a position among the giants. The lens as first reached by a cross-cut from the shaft appeared to be of no special importance as to size, and also to be somewhat out of place. As the drift progressed to the eastward, however, the series of cross-cuts determined the fact that the false foot wall was receding gradually to the southward, that is, towards the true foot wall, while the hanging kept its proper course. This widening of the deposit continued until the true quartzite foot wall was reached when the ore body was found to have a width of upwards of 70 feet. And the best of it is that the ore is of the highest grade yet produced by the mine.—[Pick and Axe.

The Eureka now has fully 10,000 tons of ore on the dump at No. 1 shaft, and the pile is still growing at the rate of about 200 tons per day. Cross-cutting is still in progress at No. 2, with good prospects of soon being in readiness to begin raising ore. Development work will also be vigorously conducted on the eastern part of the property, formerly known as the Gogebic, if the demand for iron warrants it.—[Pick and Axe.

There are good sized stock piles at most of the local mines, the Norrie having about 300,000 tons of ore above ground. But, as one of the mine superintendents remarked, "it will keep."—[Pick and Axe.

MENOMINEE RANGE.

The Ludington stockpile now contains about 30,000 tons, and they are now raising daily about 600 tons, all of which is shipped to Gladstone.—[Menominee Range.

At the Ludington the entry on the north side of A shaft at the 14th level has progressed a distance of 45 feet. The drift has gone through ore all the way, and there are not as yet any signs of the hanging wall, and it may not be encountered for some time.—[Menominee Range.

The indications for the development of an extensive mine at the Waucedah are very good indeed, and at a comparatively short distance down a small vein, which varies considerable in width, was found. The workmen drifted in on this vein for a short distance and soon secured about 1,000 tons of ore, which is of a soft blue character, and the assay shows it to be very high in iron. At the present time there are two shafts, each 105 feet in depth, but it is the intention to sink a distance of 300 or 400 feet and then cross-cut.—[Menominee Range.

While working in the drift which is being carried to No. 2 shaft at the Hamilton, the workmen encountered an entirely different lense of ore from the one which has been producing ore at this mine. When the ore was struck the drift had gone through soap-stone for a distance of 28 feet, and since the ore was discovered the drift penetrated it about 15 feet. The ore is of an entirely different character from that now found in the Hamilton, being a mixture of red and blue ore and not so high in iron. The width of the vein has not been ascertained, and it may be that the drift has only penetrated the top of what may prove to be a wide and deep lense.—[Menominee Range.

One of the busiest spots in Florence County to-day is the locality known as the Commonwealth Co.'s new find, situated on the southeast quarter of the southeast quarter of section 34, 40-18—half a mile distant from the old Commonwealth mine, and about two and a half miles from this city. The new find is destined to become one of the largest and most valuable iron properties on this range, and present indications warrant the prediction that it will eventually rival the great Chapin as an ore producer, and its product is nearly equal in quality to that yielded by the big mine at Iron Mountain. Quite a location is sure to spring up at the new find, it being favorable and admirably adapted for one. The new find now shows up a length of 700 feet and 113 feet in width, eight or ten shafts and pits all being bottomed in ore, the quality of which is excelled by no other mine in this county. Two east and west drifts and a crosscut to the north in shaft No. 1 are all breasted in ore for more than 40 feet, and the shaft itself, which is 80 feet deep, is all in ore, except, of course, a few feet of surfacing. A line of test pits, ranging considerably less than 100 feet apart, and all in ore, have been put down in a northeasterly direction from No. 1. Shaft No. 7, 320 feet from No. 1, and more to the west, has encountered the ore in a northeast crosscut at a distance of 17 feet from the shaft, the shaft being down some 50 feet.—[Florence Mining News.

The Florence has not yet shipped a pound of ore, and so far there are no prospects of immediate shipment. Last year the Florence commenced shipping as early as April 8. The situation is somewhat gloomy just now, but everybody anticipates brighter times ahead. There is said to be a million tons of ore in sight at the Florence.—[Florence Mining News.

MARQUETTE RANGE.

Reliable reports from the U. S. Grant property, on the East Negaunee range, and in which Marquette capital is so largely interested, are to the effect that the drift north from the bottom of the shaft struck the ore, and had penetrated the body 22 feet. The ore is a soft hematite, and is declared to be identical in quality with that of the famous Negaunee mine which adjoins the property on the west.—[Marquette Mining Journal.

At the Fitch mine they will sink another lift, the showing in the present bottom of the mine warranting that expenditure of capital and labor. The ground shows more uniform and regular in the bottom, and it is thought that something good may be found by sinking deeper.—[Florence Mining News.

Exploratory work will be resumed at the Noyes-Hallet find, in the town of Commonwealth, a new company being organized at Menominee to operate the property.—[Peninsular Record.

The Pittsburgh & Lake Angeline Co. has evidently struck a large deposit of ore at its exploration at the east end of the lake. The drift being run from the bottom of the shaft at that point encountered ore at 70 feet southwest of the shaft. The miners are now into the ore a distance of 12 feet, and there is every indication that a good mine will be developed. The ore is a dark blue, gives 65 50 in metallic iron, and .014 in phosphorus, a most desirable product.—[Florence Mining News.

In the extreme east end of the Dexter mine they have struck ore much resembling that of the American mine, but enough has not been done to give an idea of its value. It would give about 67 per cent. in metallic iron, probably, and was the first of the kind ever found in the mine. A large deposit of ore of this quality would be a good thing for the Dexter.—[Florence Mining News.

At the Riverside the drill was placed and a boring started into the foot. Four feet of magnetic ore of good quality was cut, after which the drill struck slate ore. From the latter no core was obtained, owing to the friable nature of the ore, but it is thought that the latter is of good quality. This has not been satisfactorily determined as yet, however, yet the presence of slate ore in any form is looked upon as an encouraging feature.—[Iron Ore.

Important gains of ore have been made at the North Jackson, these being at Nos. 3 and 4 shafts. At No. 3, which is the most northerly opening on the property of the company, they have two levels, and sinking is now in progress for the third. What was for some time supposed to be the foot of the deposit at this point was broken into for a distance of about four feet, and the existence of a body of fine ore revealed. They have drifted into the new find for something like 15 feet, and as yet have not passed through it. The ore here obtained is a Bessemer of fine grade. Several hundred feet to the northwest from this shaft they have found ore with the diamond drill, and are now drifting for it. The boring indicates a large deposit. To the south of No. 3 shaft several hundred feet is No. 4. This shaft is 230 feet deep, and they have opened one level. A late discovery of hard ore has been made here, the latter overlying the hematite, is of Bessemer quality, coarse, granular and fine-grained indiscriminately mixed, and a neat stockpile has been secured since the time the presence of the ore was made known, a few months ago.—[Iron Ore.

A correspondent of the *News*, in speaking of the rich find in the vicinity of Messambria, says that at section 34 the H. B. L. mining camps are engaged in putting down test pits to ascertain the formation. At the Michigan, on 22, the work is being run day and night. The whole shaft, which is ten feet in length across the vein, is in ore, while the north wall is solid ore. As soon as sufficient depth is reached a crosscut will be run to the north to determine the width of the vein. Late assays of the ore made by Prof. Palmer, of Ypsilanti, Mich., are very favorable. Two samples were taken—No. 1 supposed to be as lean as any coming from the shaft, and No. 2 supposed to be as rich in iron as any. The assays gave the following, No. 1, metallic iron, 58 40; No. 2, metallic iron, 68.1. This ore is low in phosphorus, showing it to be within the Bessemer limit. At the Washtenana the south part of the shaft is in fine ore. The north part is in hanging wall. It was supposed the shaft would soon pass through the hanging wall, but the dip is so slight—the rock standing nearly perpendicular—that this expectation has not been realized. The formation is the same as at the Republic and Champion mines, and the captain says the ore is almost identical with that at the Champion, at the same depth.

An Electric Hammer.

An electric power hammer has been devised which represents a radically new application of electro magnetic principles. In general design the hammer is quite similar to the steam hammer, with its vertical cylinder mounted upon its arched frame, and the rising and falling piston by which the hammer-head is carried. The novelty of the apparatus lies in the substitution of electro-magnetic power for steam by a slight and very simple modification of the mechanism. The piston is of magnetic material, and the cylinder is composed of a series of coils, through each of which an electric current may be passed separately. The apparatus is virtually an immense electro-magnet, the cylinder being the coil and the piston answering to the core. The passage of an electric current through the coils forming the upper part of the cylinder, raises the piston into the magnetic field thus created. By cutting off the current and simultaneously transferring it to the lower coils of the cylinder, the piston is released, and its descent is accelerated by the magnetic attraction created below. As a magnetic field can be created in any of the series of coils, the blow may readily be shortened or lengthened as desired. The current is controlled by levers and connections identical with those used on an ordinary steam hammer. The absence of the steam pipe is the only feature distinguishing the machine from the common steam hammer.—[Mining and Scientific Press.

Peculiar Phenomena in Welding.

Iron is now plated with nickel by pressure between rolls at a welding heat, the nickel being recovered from the clippings and shearings of the plates by the action of dilute sulphuric acid at a temperature of 55° C.; the iron is dissolved, and the nickel is obtained in the form of thin sheets, as it was melted upon the iron. The operation is complete when the evolution of hydrogen ceases—even fresh acid at the same temperature has practically no effect. But though the separation of the two metals is apparently made, a curious fact is noted, namely, that when the residual nickel is chemically examined, it is found to differ from its original composition, the amount of iron present being notably increased. For example, in a nickel containing originally only .09 per cent. of iron, 2 per cent. more was found when it was recovered from the plate cuttings, and even by a long continued treatment with dilute acid, the iron could not be sensibly reduced. This peculiar behavior, it is believed, points to the possibility of positive chemical combination taking place between the metals, and that alloys of iron and nickel are produced in the process of welding—it being a fact very well known to chemists and metallurgists that iron, with but even a small proportion of nickel, resists the action of acids much more effectively than the pure metal.—[Australian Mining Standard.

STEAM ENGINES AND BOILERS.

To enable our readers who have a call for anything in the way of steam power to secure an outfit embracing all the desirable features and improvements that have been found of advantage after years of practical test in actual work on the market, we herewith briefly illustrate and describe the popular center crank engine, with self-contained, return tubular boilers and improved upright engines with submerged tubular steel boilers, built by the old original and widely-known firm of James Leffel & Co., Springfield, O.

Fig. 1 represents the horizontal engine mounted on iron bed when used as a stationary engine separate from the boiler. The main frame of the engine is cast in one solid piece, and is of the class known as straight-line engine, with

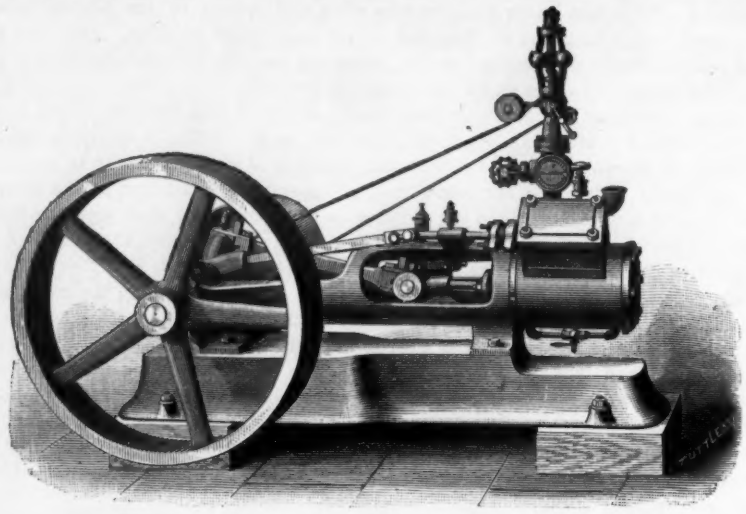


FIG. 1.

center crank and bearings on each side, which are of more ample proportions than customary, thereby insuring great endurance and stability. The cylinder end of the frame is turned accurately in lathe, and the guides for the cross head are bored out in exact line with the cylinder, making a concave surface to the guides, so as to insure the cross head from any possible binding or heating on the sides. The cross head is constructed with adjustable gun metal gibs or followers. The cross head with its pin and connecting rod, as also the crank shaft, are made of pure homogeneous solid cast steel—the new high-grade steel produced by the Bookwalter-Robert process. The cylinders are cast of carefully mixed iron, so as to insure the best results in regard to tenacity and density, as also are the pistons and valves. The cylinders are covered with asbestos and Russian iron jacket with brass band trimmings. The well-established D slide valve is used, of proper proportions, adapted to

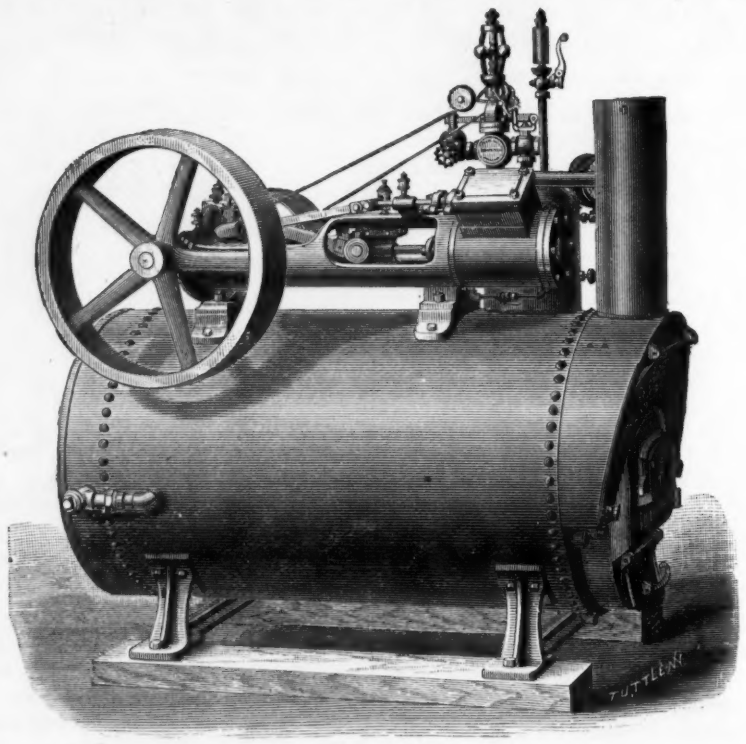


FIG. 2.

the service and speed of the engines, the eccentric for operating the valve being arranged to fasten in position to crank shaft with a cap screw, having two holes for said screw in web of eccentric, so that by changing the screw from one hole to the other, the engine is adjusted to run in the opposite direction. Each engine is supplied with throttle valve and safety governor, which insures the stopping of the engine in case of breaking of the governor belt. The engine is supplied with a large, heavy flywheel pulley on one end of the crank shaft, and a smaller pulley on the opposite end, so that the purchaser can have the advantage of driving either high or low speed shafting from the engine as desired, said pulleys being interchangeable.

Fig. 2 shows this engine on horizontal steel boiler. These boilers are of the class or style known as the Cornish return tubular boiler, the same style as are almost universally used upon ocean steamers, which is a guarantee of their safety and efficiency; for all places in the world where the absolutely best boiler is required, it is for that purpose. In this construction of boiler the firebox consists of a large cylindrical flue surrounded by water, extending the entire length of the boiler, in the front end of which is placed the furnace with the bridge wall at back end of the grates, which are of unusual length, making a long furnace and ample grate surface. This will be appreciated by engineers, particularly when wood is used for fuel. Back of the bridge wall is

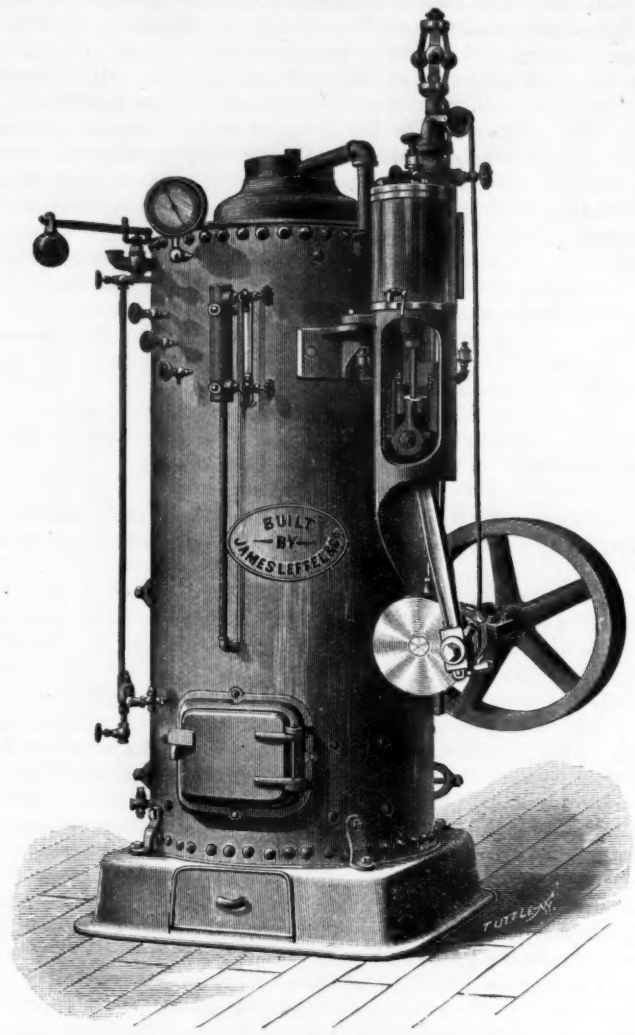


FIG. 3.

a combustion chamber, the entire diameter of the furnace flue, its rear end having a chamber extending upwards for the return of the heated gases through a series of best quality American lap welded tubes, the length and diameter of tubes being properly proportioned to the size of the boiler. The

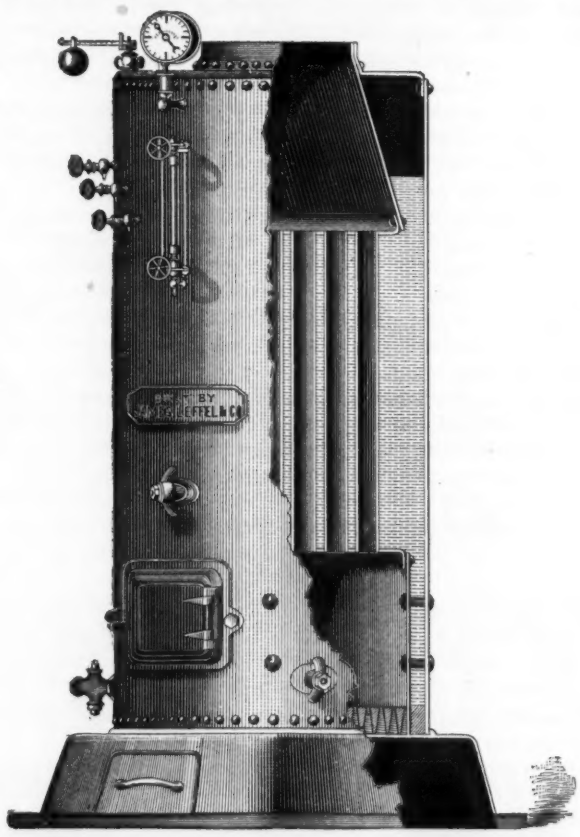


FIG. 4.

rear end of the boiler is constructed with door for the ready inspection and cleaning of that portion of the boiler, this part having a special improved patented fire-proof lining, which protects the head and retains the heat within the combustion chamber. The front end of the boiler has the furnace fitted with substantial double plate hinged door, and also hinged doors for the ash pit and the smoke bonnet, the latter of which can be readily opened by turn-

ing a button and free access had for the purpose of cleaning and examination of all the tubes. The entire boiler is constructed of steel, the cast iron used upon it being of the best quality of hot blast charcoal iron, the highest grade of that metal known in the arts. Therefore, in obtaining one of these boilers the purchaser can rest assured of procuring one of the very best articles of the kind at present manufactured. These engines and boilers are furnished in six sizes, viz: 5, 8, 10, 16, 20 and 26 horse power, and in various combinations and styles.

Fig. 3 represents their new improved construction of upright boiler and engine combined. The engine frame is one solid casting of best material, with main bearing and guides all in one piece, the same accurately fitted and upper end of frame faced in lathe and cylinder attached to same, the frame being fastened to saddles which are attached separately to the boiler. All of the working parts of these engines are constructed with the same care, as regards material and workmanship, as detailed in the description of the horizontal engines herewith.

Fig. 4 illustrates interior construction of their new upright submerged tubular steel boiler, by which it will be seen that the entire length of the tubes and the upper tube sheet are submerged in the water. Their durability and safety are thus greatly increased, as they are not subjected to superheating and unequal expansion, as in the case of the ordinary boiler, with the tubes extending through steam space to upper tube sheet at the extreme top of the boiler. These boilers are more expensive to manufacture than the ordinary upright boilers offered on the market, but customers will find it a judicious outlay to get the best when purchasing. The uprights are furnished in three sizes, viz: three, four and one-half, and six and one-half horse-power.

A nicely illustrated descriptive pamphlet replete with valuable and useful information, will be sent free on application. Dealers wishing to handle a line of engines and boilers possessing superior merits for practical efficiency and adaptation for all kinds of work, will benefit themselves and their customers by writing the manufacturers, James Leffel & Co., Springfield, O., whose Eastern office is at 110 Liberty St., New York City. This company have been engaged in the business for a long number of years, and have successfully introduced more than 4,000 of their engines on the market, having them in use not only in every State in the Union, but in foreign countries as well; and the demand is continually increasing, demonstrating beyond a doubt their claims for superior excellence.

THE SMOKE NUISANCE IN CITIES.

The rapid increase in the number of locomotives and stationary engines of all kinds used in our cities, and the added fact that in the West soft coal is used very largely for steam making, has made the resulting production of smoke a very serious evil, and many devices have been tried for obviating it. In Chicago the city authorities have been for several years endeavoring, under stringent municipal regulations imposing penalties for the emission of smoke in excessive quantities, to compel railway companies, manufacturers and others to abate what has become to be known as the "smoke nuisance." Various promising appliances after thorough trial failed to accomplish the result, but the city authorities persevered and improved devices were brought into use, the number in service being gradually reduced as the results of experience until finally the attempt to relieve the city from the pall of smoke which hung over it seems to have been nearly successful, as appears from the following report by the chief inspector of the health department. We will add that the gratifying results here noted appear to be due very largely to the use of the Hutchinson fuel and gas furnace, a device for preventing sparks and smoke, and also for economizing fuel, which has been used for several years and is now to be found on the locomotives and stationary boilers of nearly, if not quite all the railways, and a large share of the manufactories in Chicago:

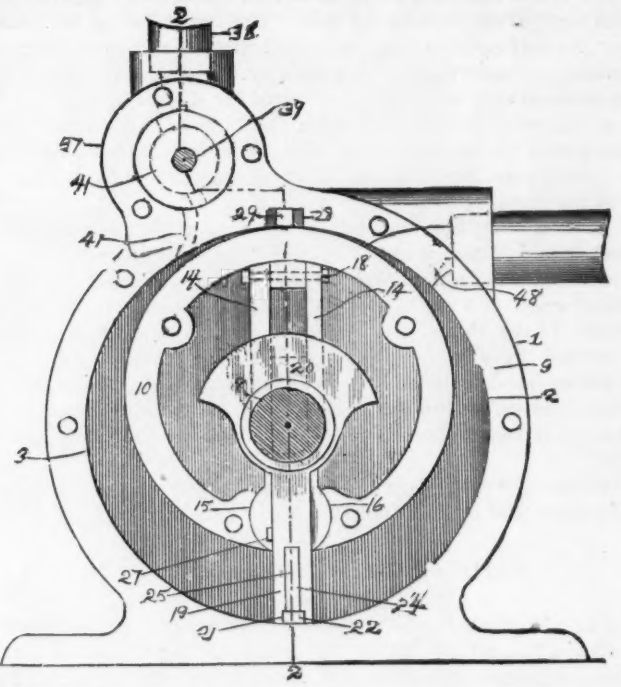
There is no longer any doubt of the practicability of abating the smoke nuisance upon railways, as is shown by the following report of what has been accomplished by the roads running into Chicago during the past year, beginning with March 1, 1890: The Chicago & North Western has abated the nuisance on 64 locomotives and 166 stationary boilers in its depots, office building and shops. The Pittsburgh, Chicago & St. Louis on 18 locomotives, one boiler in its shop, and has contracted to equip all other engines running into Chicago. The Pittsburgh, Fort Wayne & Chicago has ten locomotives equipped. The Chicago & Northern Pacific is engaged in equipping all its locomotives running into Chicago. The Lake Shore & Michigan Southern has equipped 68, and that number comprises all the locomotives running into the city, including passenger, freight and switch engines. The Chicago, Rock Island & Pacific has equipped 24 locomotives with new devices and repaired 38 old ones, some of them having been in use for the past six years, and has equipped the boilers at its elevators A and B. The New York, Chicago & St. Louis has equipped eight locomotives and contracted for ten more, which will cover all the engines this road has running into the city. The Chicago & Erie has equipped 18, and has assured the department that it will continue the good work until all the engines running into the city stop their smoke. The Chicago & Grand Trunk is now engaged equipping all its engines running into the city; it has seven equipped, and has promised to finish them all before Summer. The Belt road has equipped eight locomotives and the boilers at the Dearborn station. The Chicago & Eastern Illinois has equipped nine new and repaired 16 that have been in use several years. The Baltimore & Ohio has all its engines equipped running in the city, 35 in number, and reports them being highly pleased with the results. The Illinois Central has succeeded in stopping the smoke on twelve of its engines, and promises a complete abatement of the smoke nuisance in the near future. The Michigan Central is engaged upon 39 of its engines running into the city and has 13 of them already working satisfactorily. These results are very satisfactory, and establish beyond a question that it is practical to abate the smoke nuisance. Many of the other roads running into the city have made experiments during the past year, but have reported little progress and a good many failures. This department has decided that sufficient time has been given to those who have not yet complied with the ordinance, and a vigorous prosecution will be commenced against those who have neglected or refused to comply. Much more has been accomplished in abating the nuisance in factories, hotels and office buildings, a report of which will soon be ready for publication.

(Signed.) ANDREW YOUNG, Chief Inspector Health Department.

CHICAGO, April 1, 1891.

AN IMPROVED ROTARY ENGINE.

In most rotary engines, the fatal defect, it is claimed, lies in the lack of means to effect the necessary movements of the piston and the bearing abutments, so as to avoid strong impact or knocking movements that soon pound loose and are short lived. As rotary engines generally revolve rapidly, it is essential that the shifting parts be arranged to move as easy as possible. The present invention patented by Mr. Abner D. Baker, of Swanton, O., is a notable example of the attainment of the desired end, and is seemingly the nearest approach to the desired object that has yet been attained, and is practically perfect. The illustration presents a side view of the interior, showing the relation of the case, revolving drum and engine shaft, with the casing and steam chest. The abutment or drum revolves on a different center from that of the shaft, and is therefore in constant peripheral contact with the top of the chamber. A transverse packing strip bears at the highest point of the drum contact, and stops the steam so that it must exert its power against the piston that moves around in contact with the shell. The piston is keyed to the engine shaft, and is counterbalanced in its revolutions, securing perfect smoothness. As the packing in the end of the piston bears against the inner face of



the shell, which is concentric to the shaft, there is no reciprocation of the piston, in fact, but only a seeming reciprocation in relation to the eccentric, there being no movement of the piston, in fact, except its smooth and uninterrupted rotary movement. The valve gear is so arranged as to permit of adjustment to cut off at any desired portion of the stroke, so that the engine can run partially upon expansion. The engine works very smoothly, and gives great power with economical use of steam. It will be seen at a glance that there is no stroke or reciprocation of any of the parts within the engine. The only reciprocating part is the pitman, and the valve which is operated by the pitman, being driven by a crank on a centrally located driving shaft. The abutment or drum has long tubular arms or sleeves, which revolve on bearings in the cylinder heads. All of the working joints have a uniform sliding contact, which makes the engine run very smoothly. The revolving parts are all balanced so that there is no vibration, no matter what the speed is or how heavy the load. The piston being keyed to the shaft and carrying its abutment with it, obviates all start and stop motions. By this engine the highest degree of expansion is obtained, thereby securing a great economy in steam. It is claimed to be entirely practical, and especially when applied to run an electric dynamo, as it may be attached direct.

Testing the Hardness of Metals.

A method for testing the hardness of iron and steel while in the process of manufacture has been invented by Mr. C. A. Casperson, Forsbacka Iron works, Margretshill, Sweden. The inventor, it is said, conducts a current of electricity through a test piece of iron or steel, letting it melt the same, upon which the strength of the current necessitated in the operation is compared with the strength of current required for the fusion of a standard piece of metal of determined degree of hardness, and of the same diameter as the piece to be tested. The hardest piece will resist longest, but melt if the current be maintained sufficiently. By the aid of an ampere meter, metals of varying hardness may be tabulated, so as to furnish a scale, it is said, of hardness.

LINE shafting should never be placed along the side of a room so that all the machinery will be belted from one side. Eqalize the strain on the shaft by placing the machines on both sides. For this reason the shaft should be run through the center of the room.

METAL AS A SUBSTITUTE FOR WOOD IN RAILROAD TIES.

The report of the Forestry Division of the United States Department of Agriculture, on the consumption of wood for railroad ties, seems to establish the fact that this consumption is a leading factor in the depletion of our forests. Besides many interesting statements regarding the destruction of young trees, the report also contains the results of an exhaustive inquiry as to the use of metal by railroad managers, in this and many foreign lands, and this method of construction is suggested as one remedy for the denudation of our forests, which is generally acknowledged to be going on at the present time.

This portion of the report was prepared by E E. Russell Tratman, C. E. The statistics are given of 25,000 miles of railroad laid with metal track out of a total mileage of the world (exclusive of the United States and Canada) of 187.721 miles, or a relation of 13 12 per cent. to this total mileage.

In foreign countries the use of metal, for wood, on railroads has passed beyond the experimental stage. Practical tests are now being made in this country, and interest in the subject among railroad men is increasing.

A section of track on the New York Central & Hudson River road, about a quarter of a mile in length, was laid with the modified "Hartford" tie. Mr. Walter Katte, the engineer of the road, reports as follows regarding this experiment:

"The ties (metal) were laid in November, 1889 The line has the heaviest kind of freight and passenger traffic. Passenger engines, with a weight of 36 tons, on four driving wheels and a driving wheel base of six feet, pass over these ties at speeds of 40 to 55 miles per hour. The ties have not been in use long enough for the expense of maintenance to be determined. Apparently, it is thus far no greater than with wooden ties. The reason for using these ties was the desire to secure economy over wooden ties, and to obtain a superior attachment of the rails to the ties. The result has so far been quite satisfactory. I am of opinion that the rolled metal tie is essentially a requisite for first-class permanent way in this country. Having investigated the relative economy of metal and wooden tie systems for a term of 50 years, I am led to believe, as the result thereof, that upon the basis of 55 cents for a wooden tie and $3 for a steel tie, and under the same conditions of traffic and maintenance expense existing on this line, the relative economy is from 8 to 12 per cent. in favor of the metal system."

The general adoption of metal in place of wood for railroad ties would check the enormous consumption of the young growth of our forests. On this point Mr. Fernow, of the Forestry Division, makes this forcible statement: "The use of wood, and the method of using it, are largely matters of custom everywhere. In the United States, the enormous supplies which the native forests yielded have not only induced a very extensive, but also a very wasteful use of wood, until now we have reached a point when the prospect of reduced supplies makes the study of economics a matter of national concern, and within a not too distant time private interest will also awaken to the need of it."

To inventors, a wide field of study and usefulness is open, in devising good and economical applications of metal for ties and rail connections.

NATURAL GAS AS A MOTIVE POWER.

When an addition is made to the works occupied by a manufacturing company, a wing to the main building, for example, the question of getting power into the new department becomes of a surpassing importance. Particularly is this the case if there is no immediate occasion for carrying a line shaft through that portion of the building lying between the engine and the new department. Conditions similar to these recently arose in the works of the Michigan Stove Co., Detroit, Mich., on the completion of an addition to their building. The lower floors of the new building are devoted to the wood and iron pattern shops and to the nickeling department. The power necessary to drive the machinery used in these several departments was estimated at no less than 100 horse-power. Several plans were suggested for obtaining this power, one of which was to use wire-rope transmission and another was to carry a steam pipe from the boiler and locate a special engine in the basement of the building. Still another was to put in a gas motor, using for the purpose natural gas, a supply of which is now piped to Detroit from the Northern Ohio gas districts. The latter plan was decided upon. It was in a sense, however, an experiment both for the company and for the parties supplying the gas engine. Instead of using a single motor, which would have been employed had it been available at the time, two 50 horse-power gas engines were introduced, and, singular as it may seem, they were belted directly on to the same shaft. Natural gas of the quality used in Detroit, it is claimed, is of at least 25 per cent. greater explosive force under the conditions in which it is used in a gas engine than ordinary artificial gas.

This fact was responsible, in part at least, for the failure to secure satisfactory results; for the experiment, under the conditions we have named, was not entirely successful. Still other adverse circumstances are to be noted. Belting directly upon the same shaft, in view of the fact that there was an irregularity in the motors, owing to a difference in time in the explosion of the gas in the respective cylinders, caused the two engines—a part of the time, at least—to pull against each other. This extended to such a degree as to frequently break the machinery, causing in one case the fracture of a pulley rim and in another case friction heat, which fairly welded a bushing on to the shaft. In explanation of the failure it was claimed that the engines were rated for the gas commonly used, and that if a change in this regard could have been made the results would have been far different. The gas was ignited by an electric spark, and, notwithstanding careful adjustment to secure simultaneous ignition, it was difficult to avoid occasional variations. A third engine, being of the same pattern, but of much smaller size, and using ordinary city gas, was used for starting the large engines. A peculiarity of gas engines under the circumstances described, which the reader may have noted, is that they start off at full speed. On the other hand, a steam engine starts slowly and gradually warms up to its work; but a gas engine has no preliminary steps. This results in unusual strains. After working with the gas engines under the circumstances named for considerable time and at considerable cost to the company, notwithstanding the motor people were to make no charge for the engines unless satisfactory, the experiment was declared off by the company, and on the occasion of a recent call at the works we found preparations well advanced for installing hempen-rope transmission. The distance that power is to be conveyed is not so great as to make the scheme of carrying steam in a pipe impracticable; but the hempen-rope scheme—something that is at present very popular with engineers in different directions—seemed to have greatest favor.—[Metal Worker.

Domestic Tinplates.

A recent announcement was to the effect that an important establishment had resolved to abandon the erection of a contemplated galvanized sheet works, and to devote whatever capital and energy might have been required in that direction to the manufacture of tinplate. The admitted reason for this change of purpose was that under existing trade conditions the manufacture of tinplate held out more inducements than the manufacture of galvanized sheets. It must be confessed, however, that progress in domestic tinplate making has not been so rapid as many people hoped that it would be. Tinplate and terne plate are being made at several works, it is true, and preparations are going on looking to the erection of other plants, but there is a conservatism, a deliberation, about the whole proceeding which is decidedly at variance with the activity promised by the advocates of a tinplate industry. It had been supposed that a large number, if not a majority, of the sheet mills would add cold rolls and tinning stacks as soon as adequate tariff protection was assured.

It has been urged that if there is ever to be a time when the manufacture of tinplate will be taken up by the sheet men generally they could hardly find the conditions more favorable than they are at present. An accidental meeting at Pittsburgh of a number of iron manufacturers interested in the development of a tinplate industry has led to a movement which is likely to carry out this suggestion, and it was decided to hold a meeting in this city on April 28 to discuss the advisability of employing some person to carry out the plan. C. R. Britton, of Cleveland, O., has been appointed Secretary *pro tem.* to arrange for the meeting, and already reports an earnest interest in it. While, of course, all the sheet mills in the country are not adapted to rolling sheet for tinplate, a number of them unquestionably are. We are informed that the assurance of a regular supply of black sheets at a suitable price is all that is needed to lead capitalists to embark in putting up the sufficient number of tinning stacks.—[Metal Worker.

The Tack Combination Formed.

At a meeting of representatives of the tack companies which have been planning a combination on the programme outlined in the last issue of *Hardware*, held in Boston, on April 18, the Atlas Tack Corporation was formed with a capital of $700,000. Officers were elected as follows: President, Henry Hobart, of East Bridgewater; Vice-president, Thomas J. Lathrop, of Taunton; Treasurer, Joseph H. Parks, of Plymouth; Clerk, Joseph Pettee, of Whitman. These gentlemen, together with Cyrus D. Hunt, of Fairhaven, form the directorate of the corporation. The plan, it seems, is to form a blanket company, which will absorb the individual concerns and then buy out the A. Field & Sons' plant at Taunton. The latter company were not represented at the meeting.

The idea is then to concentrate the manufacture of wire nails in one place, another branch of the industry in another mill, and so on, so as to reach the greatest economy. Of course little can be done in the way of fixing an arbitrary price list, the fact that there are 3 000 tack machines in the country being a perpetual stay on any design in that direction. The history of the business also shows a bitter experience in the matter of fixing prices. When the tack manufacturers combined several years ago they at first were satisfied with a moderate profit. A high tariff protected them, and all would have been well, but 10 per cent. dividends gave way to 15, cupidity took 20, and then "the bit was taken" and 30 was considered none too good. Capital discovered the golden mine, and almost any one who could talk tacks found it possible to obtain a moneyed partner, and when the end came, 80 concerns were uncovered to the light of statistics. The impetus was on, however, and the number did not stop there. It was the killing of the goose that laid the golden eggs with a vengeance not often seen. Now there is nothing to be made without the closest economy on the part of all concerned.—[Hardware.

Population of German Cities

Leading German cities have grown quite rapidly in the last five years, as is shown in the following table including cities of over 200,000 inhabitants, prepared from figures given in *Engineering*:

	1889.	1890.	Per cent. increase.
Berlin	1,315,000	1,574,500	19.7
Hamburg	471,000	570,500	21.2
Leipsic	193,700	353,300	82.3
Munich	261,900	344,900	31.7
Cologne	239,500	282,500	18.0
Dresden	246,000	276,000	12.2
Magdeburg	160,100	200,100	25.0

"This," says *Engineering News*, "is faster even than the average of corresponding American cities, and is one of the most notable phenomena of modern times."

STRUCTURAL iron beams have for years been sawed by machinery operated by steam, but an ingenious Boston concern doing a great amount of this work has discarded the engine for the electric motor which works so far very well

THE LEE SMOKE BURNER.

Any method by which smoke can be prevented from issuing from the chimneys of manufacturing and other plants where steam engines and boilers are used, will, if adopted, result in greatly benefiting the community at large; and, if in addition to entirely preventing the smoke, the apparatus also actually saves a very large percentage of the fuel, which would otherwise be required, the matter is one which appeals directly to the pecuniary interests of the owners of steam plants themselves. The Lee Smoke Burner & Fuel Saving Furnace Co., 167 Dearborn street, Chicago, whose smoke burner is herewith shown, guarantees the accomplishment of both of the above results.

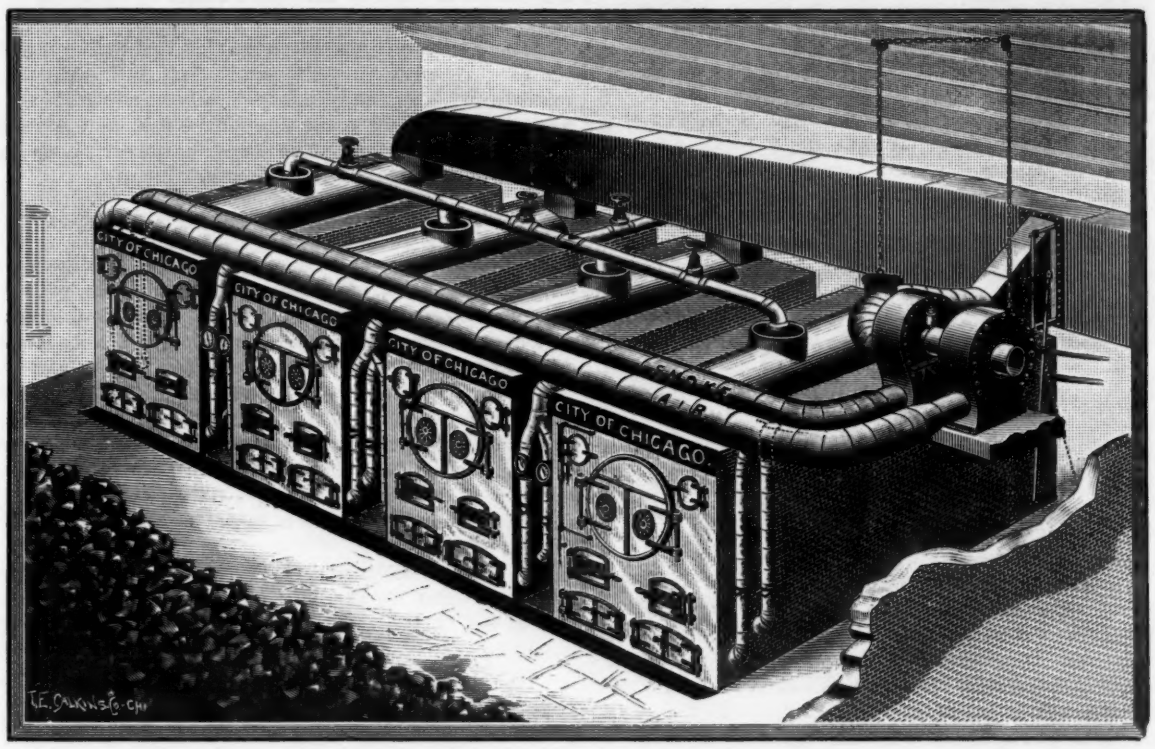
The principle upon which the Lee smoke burner works is a very simple one. When heat is applied to bituminous coal, a gas is generated which burns freely, if mixed with a proper amount of oxygen. If, however, at the time that heat is applied to the coal, a sufficient amount of air is not admitted, the gas escapes through the smoke stack in the form of smoke, which is the ordinary illuminating gas in a crude state. By the use of the Lee smoke burner this gas, or smoke, is taken from the breeching just before it enters the stack, and is forced by one side of a twin fan through pipes, and returned to the furnace above the fire. The other side of the fan gives a forced draft (which is admitted to the furnace beneath the grate bars), which, mixing with the smoke returned, results in as perfect combustion as the laws of nature will permit.

On Saturday, February 21, 1891, the first test was made for the sole purpose of ascertaining what the machine would do in the way of preventing smoke. There were present at this test Commissioner of Public Works Purdy, City Engineer Cooke, Assistant Engineer Freund, Chief Smoke Inspector Young, Chief of the Fire Department Sweenie, the heads of nearly all the city departments together with a large number of aldermen and other prominent citizens who felt an interest in the abatement of the smoke nuisance, and the enforcement of the city's ordinance in regard thereto. The result was satisfactory in the highest degree to all present. The large furnaces were run for two hours with the burner in operation, during all of which time no smoke issued from the chimney. It was then suggested that the burner be detached, which was done, with the result of causing dense volumes of black smoke to immediately appear. A fresh fire was then put into all the furnaces and the burner was again started, and those present holding watches announced that the time elapsing before the smoke was entirely stopped was just three quarters of a minute.

On Tuesday and Wednesday, March 3d and 4th, 1891, another test was made for the purpose of determining the amount of fuel which could be saved by the use of the burner. On the 3d the furnaces were fired with the Lee burner detached, and on the 4th with it running. This test was also conducted by Commissioner of Public Works Purdy, City Engineer Cooke, and their assistants. The results were also, at the same time, observed by Frederick Sargent (recently appointed Electrical Engineer for the World's Fair), and his assistants, in behalf of this company. The conditions of this test were the severest possible, and the result indicates a saving of fuel with this burner of over 7 per cent., in addition to entirely preventing smoke.

Out of several official reports, we select, as of more immediate interest in this section, the following report, under date of March 25, 1891, to Major General Thos. T. Dill, Adjutant General of the State of Ohio, by George C. Gumm, Chief Engineer of the State House:

"I beg leave to herewith report the result of my thorough investigation of the Lee smoke burner. I have seen this smoke burner in actual operation on plants consisting of one, two and four batteries of boilers. The device is simple and automatic in its working, and even careless and incompetent stokers cannot make it emit smoke, and it does not require skillful handling. The whole apparatus consists of a system of outside and inside pipes, connected with a double fan. The smoke, as it ascends from smoke stack, is caught by suction draught from one fan, and all the smoke so obtained by suction is forced back through the pipes above the grate bars. The other fan, connected with the pipes, draws hot air from above or beside the boiler, which hot air is forced through a system of pipes in shafts under the grate bars; supplying sufficient heat and oxygen as to induce a combustion as perfect as the laws of nature will permit. When heat is applied to bituminous coal, gas is generated, which is our ordinary illuminating gas in a crude state. It burns freely when mixed with the proper quantity of air. The smoke results from the failure to burn this gas. The Lee smoke burner overcomes all these difficulties through its simple construction, and reduces the smoke to a minimum. At the same time, it is my opinion that by using this device, a large quantity of fuel must be saved. I have visited the Central Electric Light plant, in the city of Chicago, and the manager of that institution tells me that the Lee smoke burner is the only one put on the market which gives entire satisfaction. He has used every smoke burner, but says that the Lee is the best. So say Markley, Alling & Co., one of the largest hardware houses in Chicago, and they add that the device is not only perfect in consuming smoke, but also a great saver of fuel. But the most important and thorough test of this device, in my opinion, is what the city (Chicago) authorities have done at their pumping station, at Bridgeport. There the Lee smoke burner is applied to four boilers, and herewith attached official report of the City Engineer to the Commissioner of Public Works of the City of Chicago, will explain itself, and corroborate what I herewith report. This official report is a matter of record, and can be looked into on the files of the city records at any time. I also beg leave to attach copies of letters, taken from the files of the company, from responsible parties using this device. I may add that some time ago, a citizens' committee, in Chicago, was appointed to investigate the merits of the different smoke consumers in use. This committee inspected 839 furnaces, which had attached different makes of smoke consumers, and out of this enormous total, they found but one single furnace which emitted no smoke, and that was the furnace furnished with the Lee smoke burner. This also is a matter of record to be found on the files of the city. The Lee smoke burner apparatus could be easily attached to the boilers of the State House, and, in my opinion, it would be the only way to abate the smoke nuisance effectively. I would add that the water used in the State House is caught on the roof, and large quantities of soot settles in the tanks. But by the use of this smoke burner, this would be done away with and would be of great benefit, and the purity of the water would add much to the comfort and health of those using it for drinking and washing, and the trees, building and surroundings would present a more cleanly appearance, besides adding much to the comfort of the residents in the vicinity, by abating the smoke, which they consider an intolerable nuisance."



THE LEE SMOKE BURNER.

If We Want to Export Rails.

Bids are about to be invited by the Government of New South Wales for the supply of 175,000 tons of steel rails, to be manufactured in the colony, the iron ore and the fuel used to be mined within its limits. The delivery of the 175,000 tons to begin in January, 1893, and continue during five years. "The prices to be paid are to be determined on the basis of the average prices ending at the time of delivery in London or Liverpool. Bids will be received by the Minister of Public Works, Sidney, N. S. W., or by the agent general for the colony in London, up to June 24, 1891."—[Bradstreet's.

New Pullman Vestibule Sleeping Cars on the Mt. Vernon & Pan Handle Route.

New Pullman vestibule sleeping cars of latest improved pattern have recently been added to the equipment of the Mt. Vernon & Pan Handle route, and run on train leaving Cleveland daily at 3 P. M., arriving at Cincinnati at 7:10 A. M.

INDUSTRIAL SUMMARY.

New Enterprises:—

It is stated that J. Alston will at once erect machine shops in Greenwood, S. C., at a cost of $11,000.

The Improved Perforated Pulley Co., Kansas City, Mo., has been incorporated with a capital stock of $24,000.

The Puget Sound Wire Nail & Steel Co. have been organized, with a capital stock of $200,000, for the manufacture of nails and wire.

The Harriman Wrought Iron Co. has been established at Harriman, Tenn., for the purpose of manufacturing wrought iron direct from the ore.

The Hyer-Sheenan Electric Motor Co. have been incorporated at Stafford Springs, Conn., to manufacture motors, governors and other specialties.

The Standard Boiler & Bridge Works, of Bellaire, O., has been chartered for the purpose of doing a general boiler and bridge manufacturing business.

The Russell Fuel Burner Co., of Chicago, has been incorporated with a capital stock of $200,000, by Charles S. Raddin, Wm. D. O'Brien and Samuel W. Adams.

J. W. McKay, W. R. Godfrey, W. A. Heinshaw and others have incorporoted the Cheraw Machine Works, Cheraw, S. C., (cotton presses, etc.) with a capital stock of $50,000.

J. M. Pickrell, of Mount Sterling, and others, have organized the Richmond Ice Manufacturing Co., for the purpose of erecting a $16,000 ice factory in Richmond, Ky.

It is stated that R. P. Smith, of Houston, Tex., is investigating for an iron and steel works company that proposes to erect a $750,000 steel and iron plant at New Birmingham.

The Post-Boynton-Strong Co. is a new incorporation at Chicago to manufacture metal specialties. The capital stock is $50,000, and the incorporators are Henry P. Post, Charles T. Boynton and William Strong.

Virgil Powers, J. A. Carlton and H L. Johnson have incorporated at Atlanta, Ga., the Carlton-Johnson Railway Signal Co. to manufacture the automatic electric block system of railway signals, etc. The stock is $100,000.

The Gould Air Brake Co. has been organized at Buffalo, N. Y. Chas. G. Gould has been elected President; Henry C. Gould, Vice-President and Treasurer; F. P. Huntley, Secretary, and Edward R. Knoweles and Ernest C. Webb, Directors.

The Toledo Bridge Co., of Toledo, has been incorporated with a capital stock of $100,000 to manufacture and construct bridges and structural iron and steel works; incorporators, James A. Huston, E. B. Smith, G. P. Waddorf, L. E. Clark and E. W. Tolston.

A company has been organized at Huntsville, Ala., under the name of the Lownes Novelty & Wrench Works, for the purpose of erecting a foundry and machine shop and a plant to manufacture monkey and pipe wrenches. P. H. Lownes, of Florida, is the owner of the plant.

The Harmon Machine Co., of Watertown, N. Y., has been incorporated, with a capital stock of $30,000. They succeed to the business of Harmon Bros., agricultural implement manufacturers. New buildings are being erected, and modern tools will be put in to do a general machine shop business. The company says, "Catalogues in this line will be carefully filed."

The New York Sewing Machine and Manufacturing Co., with a capital stock of $250,000, have been incorporated at Richmond, Va. The President of the company is Smith M. Weed; Vice-President, Thomas L. Blanton; Secretary and Treasurer, L. M. Blanton. The Directors are Frank A. Wilkinson, of the firm of Wilkinson, Geddis & Co., Newark, N. J; Hon. Smith M. Weed, of Plattsburg, N. Y; Thomas L. Blanton and L. M. Blanton, of Richmond, Va. The capital stock of the company is to be divided into 1,000 shares of six per cent. cumulative preferred stock; 1,500 shares of general common stock; par value of all shares, $100. This company will continue to carry on the business of manufacturing sewing machines and supplies, as hitherto manufactured under their name in New York.

Additions, Enlargements, Removals, etc.:—

The capital stock of the Muskegon Iron & Steel Co., Muskegon, Mich., has been increased to $200,000.

The Paige Tube Co., of Warren, O., will erect a foundry, 50x75, for the purpose of doing their own casting.

Crellin & Nalls, proprietors of the Birmingham (Ala.) Boiler Works, have doubled the capacity of their plant.

The Automatic Knife Co., of Middletown, Conn., are erecting a building 120x25 feet, three stories, to manufacture pocket cutlery.

The Scott Machine & Hardware Co., at Denver, Col, are enlarging premises to double former size, and will put in several new tools.

The Anderson (S. C) Iron Foundry & Machine Shop will be enlarged, and the making of sorghum mills will be added. R. F. Diver is the owner.

The steel works of the Union Steel Works, of Louisville, Ky., are to be removed to Lexington, Va. Work has already commenced on the new plant.

Lee & Hoff are erecting a new plant at St. Paul, Minn., for the manufacture of boiler-tube expanders, which will be double the capacity of the old plant.

It is reported that the car works of Rochester, N. Y, will remove their plant to Johnson City, Tenn., where $100,000 will be expended in establishing it.

The Case Engine Co., of New Britain, Conn., are building an addition, 34x50 feet, to their shops, and will soon have it equipped and ready for occupancy.

The Bessemer Machine & Foundry Co., at Bessemer, Ala., having commenced the manufacture of agricultural implements, will enlarge its plant and put in additional machinery.

The Pittsburgh Malleable Iron Co. have secured a lot 281 feet on Forty-third street, and extending back 130 feet, for $30,000. The purchasers will at once begin the erection of buildings suitable to the manufacture of their special product.

Pratt & Cady, of Hartford, Conn., have erected a new brick foundry, 75x240, with a monitor roof, and having a capacity of over 40 tons per day. It is wholly of iron, and a pattern room, casting-room, and storage sheds have also been built, of nearly equal size.

It is reported from Waukegan, Ill., that the prospects are good for the removal to that place of the Clinton Wire Cloth Works, now at Clinton, Mass. If they should be removed they will occupy a site near the Washburn & Moen Manufacturing Co.'s new works.

Steps have been taken towards the erection of a large factory, at West Lynn, Mass., for the projectile department of the Thomson-Houston Electric Works. The projectile department is connected with the United States Works, and when it is in full operation will require between 1,200 and 1,300 men.

A contract has been closed by the Basic City Co., of Basic City, Va., whereby the Cochrane Roller Mill Co., of Escanaba, Mich., will remove its plant to the former city. General machinery and castings, chilled grain rolls, chilled iron and castings of all kinds comprise the work which the concern will turn out.

A new stove foundry is to be built at Bangor, Maine, the firm of Albert Noyes & Co. having united with the stove department of the Bangor Foundry & Machine Co. in the establishment of this industry. A stock company will be formed to handle the business, the stock being largely controlled by these two concerns.

Smith & Silk, formerly of Cincinnati, O, have removed to Kenton, O., and formed the Smith-Silk Machine Tool Co. The shop which they occupy at Kenton is 60x200 feet, fitted with traveling cranes, several new tools, and other appliances to simplify the manufacture of metal planers and shapers, of which they make a specialty.

David Owen, Superintendent of the St. Louis (Mo.) Steel Foundry, says the plant recently burned down in East St. Louis will be rebuilt at the earliest opportunity after the insurance has been adjusted. Architects and engineers were on the ground at the time of the fire, and gave plans for doubling the capacity of the plant. The Superintendent states that the plant will be increased to at least double its former capacity.

General Industrial Notes:—

The Edgar Thomson steel rail mill, at Braddock, Pa., after being idle for about two months, will start up again shortly.

The citizens of Wabash, Ind., are reported to have raised a fund to pay the expense of suing the Indiana Steel Co. for $10,000 damages for violating their contract to locate their plant there.

No. 2 mill of Cartwright, McCurdy & Co., proprietors of the Enterprise Iron Works, of Youngstown, O., which was partially destroyed by fire in February last, has been rebuilt and was put in operation on Monday, April 20.

The Medart Patent Pulley Co., St. Louis, Mo., have issued a catalogue descriptive of their patent wrought rim pulleys, shaftings, hangers, etc, of which they manufacture a complete line. Prospective buyers of this line of goods should send for one.

F. I. Freeman, formerly President and General Manager of the Aetna Machine Co., of Warren, O., has accepted the position of General Superintendent of the Totten & Hogg Iron & Steel Foundry Co., of Pittsburgh, Pa., made vacant by the resignation of Robert C. Totten.

Mr. Alex. Carter, of Moncton, N. B., finished a nut lock bending machine of his own invention for the Thomas Nut Lock Co. The machine bends three locks at a time and is noiseless in operation. It will be sent to the United States and two more like it built at the factory at once.

The entire plant of the Katahdin Iron Works, in the State of Maine, has been purchased by a syndicate, and will be transferred to East River, in Pictou county, where iron is abundant. Over 300 hands will be employed. Among those interested are Mr. Fraser, of New Glasgow; R. G. Leckie, of Londonderry, and Mr. Sjostet.

We have before us the 1891 catalogue of the Berger Manufacturing Co., of Canton, O., manufacturers of corrugated iron and steel roofing, eave troughs, cornices, and in fact everything in that line that can be made from iron, steel or tin. They have a large factory and their goods are sent to all parts of the country. Write to them for catalogue.

We have received from Messrs A. G. Spalding & Bros., of Chicago, New York and Philadelphia, and who are their special agents, the catalogue of the Overman Wheel Co., of Chicopee Falls, Mass. It consists of 32 pages and cover, the cover being handsomely embossed in blue and white. It shows, in detail, the specialties connected with the Overman Wheel Co., and the different good points about them.

A very handsome and complete catalogue has been received at this office from the Babcock & Wilcox Co, 30 Cortlandt St., New York city, manufacturers of water-tube boilers. The book, which is entitled "Steam," is handsomely printed, contains 160 pages, with cloth binding, and is a work of art. It is fully illustrated and shows in detail the workings of their boilers. It gives a great deal of information on the application of steam and the circulation of water. Users of power should not fail to send for a copy, as it contains so much useful information.

Pedrick & Ayer, 1001 and 1003 Hamilton St., Philadelphia, Pa., have issued a large and handsome catalogue of the different kinds of tools and machines which they manufacture. Their business has grown so rapidly that they are compelled to build an addition of two stories on their present large quarters which they moved into in September, 1890. They have built up a large and increasing trade in their specialties, which are special tools for railway repair shops, Universal milling machines and their patent open-side planers and shapers. The rapid growth of their business is a sufficient guarantee to purchasers that their machines must be first class.

THE SOUTHERN IRON FURNACES.

A gentleman who has recently made a two weeks' trip through the Southern iron field writes as follows to the *Iron Age* in relation to the pig iron outlook from that standpoint:

The stock of pig iron in furnace yards in the Southern iron district has rarely, if ever, been so small. One company, with nine furnaces in blast, had a total stock of 17,000 tons on hand April 1, which was 8,000 tons less than February 1. Another company, with one furnace in blast, had 11,000 tons on hand, being 4 000 tons less than February 1, and from rate of current shipment over production by these two companies their stocks will probably be 10,000 tons less on May 1. These two have the only considerable stocks of iron in the Alabama district, other companies having generally not more than two to five days' stock on hand. Another large furnace company in the district, with a daily output of 600 tons, have not had more than 1,000 tons on their yard at any one time for several weeks.

The stocks at nine other furnaces are respectively, 550, 700, 1,279, 800, 250, 1,100, 700, 500 and 200 tons. The above companies represent all but two furnaces in blast in Alabama. The last official reports show about 31,000 tons on hand April 1 in Alabama and Georgia, and 89,000 tons in the Southern States, as against 112,000 tons on hand March 1, showing a loss of 23,000 tons in the month. Most of the furnaces in the Southern district, although they have made very light sales in the last 30 days, still have orders on books sufficient to exhaust their make for 90 days ahead. During the last three months their orders have so largely exceeded their output that many thousands of tons of high-priced contracts have been canceled by buyers on account of failure to deliver. Two companies, having one stack each, have had 5,000 and 6,000 tons respectively canceled, most of which orders were at prices ranging about $3 per ton above the present market price.

Such of these companies as last year sold iron largely by warrant have realized a very handsome profit recently through purchasing warrants for their own brands in the open market, canceling them, and shipping the iron thus obtained on their high-priced contracts, which would otherwise have been canceled. Notwithstanding this unusual scarcity of iron at furnaces and the small stocks in the hands of consumers, resulting from last Winter's panic, there is a general impression that prices will go lower in the near future. This grows largely out of the fact that new contracts have been few during the last 30 days, and the belief that the output will be largely increased by more furnaces being put in blast soon.

The large orders already booked, the small stocks on hand in yards of both producers and consumers, and the unusually favorable crop prospects, do not seem to be having the influence they should in giving confidence to producers. Should a decline in prices occur now, it will very likely result in a sharp advance some time about July, if the crops yield anything like as well as now promised. April and May are usually light buying months, whereas July is usually a heavy buying month. A little more nerve on the part of producers might prevent the decline altogether now.

Compressed Coal Dust as Used in France.

There is hardly a torpedo boat belonging to France in which the compressed coal dust is not used, and it is consumed in the battle ships wherever possible. These briquettes are generally composed of a mixture of from 8 to 9 per cent. of pitch, with 92 to 91 per cent. of coal dust. In the most improved machines the coal dust and the pitch are shoveled into a hopper, and it is not touched again until it is automatically stacked in the yard outside the engine-room. The materials are consolidated by means of a mixing apparatus into which steam is admitted. A form of coal, which, by itself, is almost useless for burning, is thus converted into a really serviceable fuel, that, as regards cheapness, may be made to enter into successful competition with the best steam coal.

Population of the World.

The world's population in 1890 is estimated in the *Proceedings* of the Royal Geographical Society, for January, 1891, as follows:

	Population.	Per cent. of total.	Average per square mile.	Increase per decade. per cent.
Europe	380,200,000	25.6	101	8.7
Asia	850,000,000	57.1	57	6
Africa	127,600,000	8.5	11	10
Australasia	4,730,000	0.3	1.4	30
North America	89,250 000	6.0	14	20
South America	36,420,000	2.5	5	15
Totals	1,487,600,000	100.0	31	8

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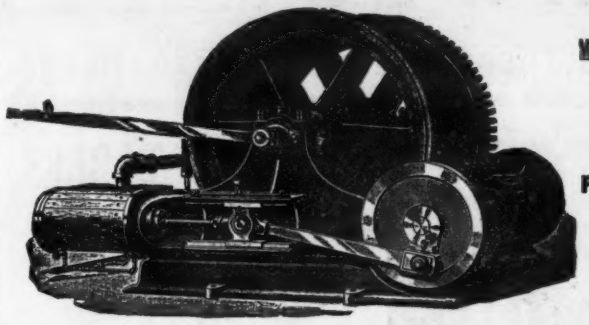

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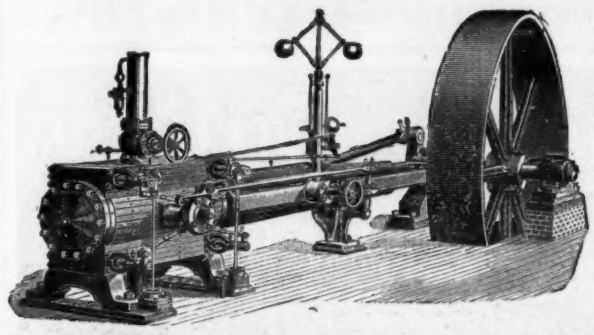

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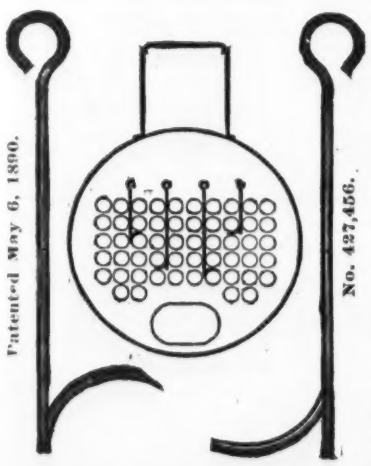

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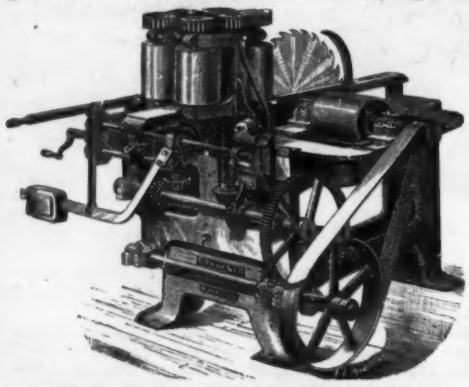

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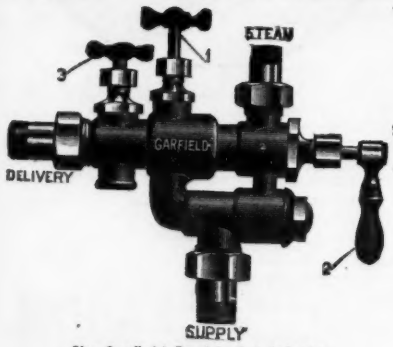

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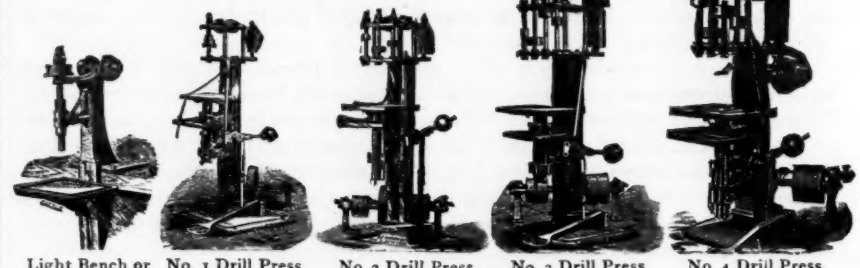

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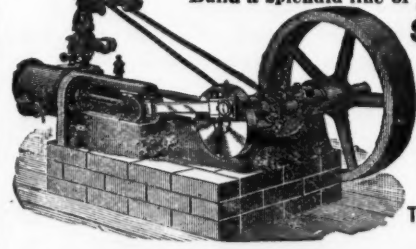

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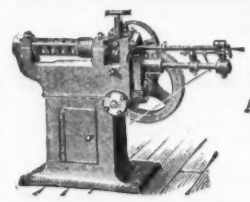

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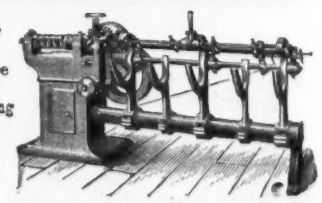

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CLEVELAND (f. o. b. cars, net cash) Bessemer, $17 30; No. 1 Foundry, $16 80; No. 2 Foundry, $15 80; No. 1 Gray Forge, red short, $14 80; No. 2 Gray Forge, neutral, $14 30; No. 1 American Scotch, $16 80; No. 2 American Scotch, $15 80.

CHICAGO (reported by Messrs. Rogers, Brown & Merwin): Southern Coke No. 1. foundry, $16 25@17 00; Southern Coke No. 2 Foundry, $15 75@16 50; Southern Coke No. 3 Foundry, $15 25@16 00; Southern Coke No 1, Softeners, $15 75@16 50; Southern Coke No. 2, Softeners, $14 75@15 50; Ohio Silveries No. 1, $18 00@18 75; Ohio Silveries No. 2, $17 00@ 17 75; Ohio Strong Softeners No. 1, $18 25@19 50; Ohio Strong Softeners No. 2, $17 50@18 75; Lake Superior Charcoal Nos. 1 to 6, $18 00@19 00; Tennessee Charcoal No. 1, $18 00@19 00; Tennessee Charcoal No. 2, $17 50@18 50; Southern Standard Car Wheel, $21 00@23 00; Tennessee Standard Car Wheel, $00 00@00 00.

CINCINNATI (reported by Rogers, Brown & Co): FOUNDRY IRONS—Southern Coke, No. 1 foundry, $15 00@15 25; Hanging Rock Coke, No. 1 foundry, $16 50@17 50; Jackson Co. Stone Coal, No. 1 foundry, $16 50@17 00; Tennessee Charcoal, No. 1 foundry, $16 50@17 50; Hanging Rock Charcoal, No. 1 foundry, $20 00@22 00. MILL IRONS—Standard Southern Coke, grey forge, $13 00@13 50; Standard Southern Coke, mottled, $12 50@12 75; Cold Short Southern Coke, grey forge, $12 75@13 00; Strong Ohio Neutral Coke, grey forge, $15 00@15 50. CAR WHEEL AND MALLEABLE—Standard Alabama Car Wheel, $20 00@20 50; Tennessee Car Wheel, $18 50@19 50; Lake Superior Car Wheel, $19 50@20 50.

BUFFALO (reported by Rogers, Brown & Co.): Mahoning and Shenango Valley strong, No. 1 Foundry, $17 50@00 00; Mahoning and Shenango Valley strong, No 2 Foundry, $16 25@00 00; Ohio Softener No. 1, $17 25@00 00; Ohio Softener No. 2, $ 6 25@00 00; Jackson Co., Silvery No. 1, $18 00@00 00; Jackson Co. Silvery, No. 2, $17 00@00 00; Lake Superior Charcoal, $18 50@00 00; Tennessee Charcoal, $18 50@00 00; Southern Softener No. 1, $16 50@00 00; Southern Softener No. 2, $15 75@00 00; Southern Strong No. 1 Foundry, $17 00@00 00; Southern Strong No. 2 Foundry, $16 50@00 00. Alabama Car Wheel, $22 00@22 50; Hanging Rock Charcoal, $23 00@24 00.

LOUISVILLE (reported by Hall Bros. & Co.) HOT BLAST FOUNDRY—Southern coke No. 1, $14 25@14 50; Southern coke No. 2, $13 75@14 00; Southern coke No. 3, $13 25@13 50; Mahoning Valley (Lake ore mixtures), $00 00@00 00; Southern charcoal, No. 1, $16 50@17 00; Southern charcoal, No. 2, $16 00@16 50; Missouri charcoal, No. 1, $17 50@18 00; Missouri charcoal, No. 2, $17 00@17 50. FORGE—Neutral coke, $12 50@13 00; Cold short, $12 50@13 00; Mottled, $12 00@12 25. CAR WHEEL AND MALLEABLE—Southern (standard brands), $21 00@22 00; Southern (other brands), $17 50@18 00; Lake Superior, $21 50@22 50.

ST. LOUIS (reported by Rogers, Brown & Meacham): HOT BLAST COKE AND CHARCOAL—Southern Coke No. 1, $15 50@15 75; Southern Coke No. 2, $14 50@14 75; Southern Coke No. 3, $ 3 75@14 25; Southern Grey Forge, $13 50@13 75; Southern Charcoal No. 1, $17 50@18 00; Southern Charcoal No. 2, $17 00@17 50; Missouri Charcoal No. 1, $15 50@16 00; Missouri Charcoal No. 2, $15 00@15 50; Ohio Softeners, $18 00@19 50. CAR WHEEL AND MALLEABLE IRONS—Lake Superior, $20 00@20 50; Southern, $19 00@21 00. CONNELLSVILLE COKE—East St. Louis, $0 00; St. Louis, $0 00.

DETROIT (reported by William F. Jarvis & Co): Lake Superior Charcoal, all Numbers, $18 50@19 00; Lake Superior (coke) Bessemer, $18 00@18 50; Katahdin (Maine charcoal), $23 50@24 00; Lake Superior Coke, Foundry, all ore, $18 00@18 50; Lake Superior Coke, Foundry, all ore, $00 00@00 00; Standard Ohio Black Band, $18 00@18 50; Southern No. 1 $ 6 25@16 75; Southern Gray Forge, $14 75@15 25; Jackson County (Ohio) Silvery, $18 25@18 75; Old Car Wheel, $00 00@00 00. Connellsville Coke, $0 00.

LOUISVILLE (reported by Geo. H. Hull & Co): Southern Coke No. 1 Foundry $14 50@15 00; Southern Coke No. 2 Foundry $13 75@14 25; Southern Coke No. 3 Foundry $13 25@13 75; Grey Forge, $12 75@13 25; Southern Coke Silver Grey, $00 00@00 00; Southern Charcoal No. 1 Foundry, $16 00@17 00; Car Wheel, $17 00@20 00.

PITTSBURGH (reported by A. H. Childs): No. 1 Foundry, $15 25@16 50; No. 2 Foundry, $15 25@15 50; Grey Forge, $14 25@14 50; White and Mottled, $13 25@13 50; Warm Blast Charcoal, $18 00@20 00; Cold Blast Charcoal, $22 00@27 00; Bessemer, $16 50@17 00.

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Flat Bar

1½ to 4 by ⅛ to 1 inch	1 80
4¼ to 6 by ⅛ to 1 inch	1 90
1½ to 6 by 1¼ to 2 inch	2 20
1¼ & 1½ by ⅛ to ¼ inch	1 90
1 & 1¼ by ⅛ to ¼ inch	2 00
⅝, ¾ and ⅞ by ⅛ to ½ inch	2 20

Round and Square.

1 to 1⅞ inch	1 80
2 to 2⅝ inch	2 00
2¾ to 3¼ inch	2 30
3⅜ to 4 inch	2 80
4¼ to 4½ inch	3 30
4¾ to 5 inch	3 50

Oval.

⅜ to 1¼ inch	2 20
⅜ to ¾ inch	2 40
½	2 60
⅝	3 00

Half Oval and Half Round.

1¼ to 3 inch	2 90
⅜ to 1¼ inch	2 50
⅜ to ¾ inch	3 10
½	3 30
⅝	4 80

Heavy Band.

¼ to 6 by ¼ and 5-16 inch	2 00
¼ to 1¾ by ¼ and 5-16 inch	2 10
½ to ⅞ by ¼ and 5-16 inch	2 30
to 6 by ¼ and 5-16 inch	3 80

Hoops.

1¼ to 4, Nos. 13 to 15	2 60
1¼ to 2, Nos. 16 to 18	2 70
1¼ to 2, No. 19	2 80
1¼ to 2, No. 20	2 90
1¼ to 2, No. 21	3 00
1¼ to 2, No. 22	3 10
15-16, 1 and 1⅛, Nos. 13 to 15	2 80
15-16, 1 and 1⅛, Nos. 16 to 18	2 90
15-16, 1 and 1⅛, Nos. 19 and 20	3 00
15-16, 1 and 1⅛, No. 21	3 10
15-16, 1 and 1⅛, No. 22	3 20
⅞, Nos. 13 to 15	3 00
⅞, Nos. 16 to 18	3 10
⅞, Nos. 19 and 20	3 20
⅞, No. 21	3 30
⅞, No. 22	3 40
13-16, Nos. 13 to 15	3 20
13-16, Nos. 16 to 18	3 30
13-16, Nos. 19 and 20	3 40
13-16, No. 21	3 50
13-16, No. 22	3 60
¾, Nos. 13 to 15	3 30
¾, Nos. 16 to 18	3 50
¾, Nos. 19 and 20	3 60
¾, No. 21	3 70
¾, No. 22	3 80
11-16, Nos. 13 to 15	3 50
11-16, Nos. 16 to 18	3 70
11-16, Nos. 19 and 20	3 80
11-16, No. 21	3 90
11-16, No. 22	4 00
⅝, Nos. 13 to 15	3 80
⅝, Nos. 16 to 18	4 00
⅝, Nos. 19 and 20	4 10
⅝, No. 21	4 20
⅝, No. 22	4 30
⅝, No. 23	4 50

Light Band.

1¼ to 6 by ⅛ to 3-16 in	2 20
1¼ to 6 by Nos. 11 and 12	2 30
1 to 1¾ by ⅛ to 3-16 in	2 40
1 to 1¾ by Nos. 11 and 12	2 50
⅜ and 13-16 by ⅛ to 3-16 in	2 70
⅜ and 1 3-16 by Nos. 11 and 12	2 80
⅜ and 11-16 by ⅛ to 3-16 in	3 00
⅜ and 11-16 by Nos. 11 and 12	3 10
⅜ and 9-16 by ⅛ to 3-16 in.	3 30
⅜ and 9-16 by Nos. 11 and 12	3 40
½ by ⅛ to 3-16 in	3 60
½ by Nos. 11 and 12	3 70

Wagon Box Iron.

⅜ inch, beveled edge, by Nos. 11 and 12	2 80
⅜ inch, " " " 13 and 14	3 00
½ inch, " " " 11 and 12	3 10
½ inch, " " " 13 and 14	3 30

Sheet Iron:

No. 10 to 14	2 65
No. 15 to 17	2 75
No. 18 to 21	2 99
No. 22 to 24	3 15
No. 25 to 26	3 30
No. 27	3 40
No. 28	3 50

Iron Boiler Plates.

Tank, ¼ inch and heavier	2 60
C No. 1, " "	2 85
C H No. 1 " "	3 10
C H Flange, " "	3 85
Extra Flange, "	4 35
Solid Fire Box "	5 10

Steel Boiler Plates—1-4 in. and Heavier.

Tank	2 75
Shell	3 15
Flange	3 45
Marine Flange	3 85
Fire Box	4 55

Above includes plates 90 inches wide.

90 to 96 in. wide	½c lb extra
96 to 100 in. wide	1 c "
100 to 104 in. wide	1½c "
104 to 116 in. wide	special

American Cast Tool Steel.

ROUND, SQUARE AND OCTAGON.	cts. lbs
1 to 2 in. inclusive	09
9-16 to ⅞ in "	09
7-16 to ⅜ and 2¾ to 3 in	10½
3¼ to 4 in	11
⅛ to 11-16 and 4⅛	10½
⅛ to 6 in	11½
¼ to 9-32 and 6⅛ to 7 in	12
3-6 in	14

Flats.

	cts. lbs
2 to 9-16 wide by 2 to ⅛ thick	9

Bessemer and O. H. Steel.

Machinery	base price, 2 75
Tire	" 2 75
Spring	" 3 25
Sleigh Shoe	" 2 75
Toe Calk	" 3 00
Cutter Shoes, tapered and burr.	" 3 00

English Tool Steel.

Jessop's	16c
Hobson's "Best"	16c
" "Choice"	36c

Burden Boiler Rivets.

⅛, ⅜, 11-16 and ¾ inches diameter	4 00
Bridge ⅛, ⅜, 11-16 and ¾ inch diam	4 00

SCRAP IRON AND OLD METAL.

	NET TONS
No. 1 R. R. wrought scrap	$19 00
No. 1 wrought scrap	17 00
No. 1 Machine cast scrap	12 00
Iron axles	24 00
Axle turnings	13 50
Wrought turning (free from cast)	12 00
Cast borings	8 00
Uncut wrought iron boilers	11 00
Steel boiler plates	17 00
Grate Bars	8 00
Pipes and flues (Clean)	13 50
Tank iron	13 50
Hoop and band iron	10 00
Sheet iron	9 50
Wrought drillings	11 00
Malleable iron	10 00

Reported by Messrs. BLACK & POLLOCK, Cincinnati, O.:

Railroad Wrought	$20 00
No. 1 Country Wrought	17 00
Stove Plate	8 75
Machine Castings	11 00
Hoop and Sheet	8 00
Casting Borings	9 00
Wrought Turnings	12 00

CLEVELAND ROLLING MILL CO.,

MANUFACTURERS OF

BESSEMER STEEL RAILS,

Blooms and Billets, Steel Angles, Forgings, Bar and Spring Steel. Steel Street Rails, Steel Oil Barrel Hoops, Wire of all Kinds, Iron and Steel Boiler Plates, Galvanized and Black Sheet Iron, Corrugated Iron Roofing, Sheet Steel.

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MANUFACTURERS OF

SHEET IRON AND SHEET STEEL

CAMBRIDGE REFINED IRON. TRADE MARK

Squared Roofing Sheets a Specialty.

CAPACITY RANGES FROM No 30 26 INCHES WIDE TO 1-4×40×120

CAMBRIDGE SOFT STEEL. TRADE MARK

CORRESPONDENCE SOLICITED

OFFICE AND WORKS CAMBRIDGE, OHIO.

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Ball-Norton (Monarch) Electro Magnetic Separator.

Phosphorus, sulphur, silica, hornblende and other impurities eliminated from Iron Ore, and non-Bessemer ore converted into Bessemer Ore. Samples treated without charge. Correspondence solicited.

H. E. COLLINS & CO., Agents Magnetic Separator Co.,

BANK OF COMMERCE BUILDING, PITTSBURGH, PA. ALDRICH COURT, 45 BROADWAY, NEW YORK

DALLIBA, CORRIGAN & CO.,

DEALERS IN

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Rooms 716, 717, 718, 719 Perry-Payne Bld'g,

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OGLEBAY, NORTON & CO.,

Successors to Tuttle, Oglebay & Co.,

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Exclusive attention given to

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COMMISSION DEALER IN

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AND METALS.

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Sam'l. L. Matner, Prest. & Treas. Fred. A. Morse, Sec'y.

Cleveland Iron Mining Co.,

Dealers in Iron Ores

from their own mines near Marquette, Lake Superior.

Rooms 4 & 5 Mercantile Bank Building,

CLEVELAND O.

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MINERS AND SHIPPERS OF

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Mines on the Cleveland, Lorain & Wheeling R. R. Capacity, 3,000 tons daily.

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CLEVELAND, OHIO.

Lake Shipping Point, Lorain O.

JAS. PATTERSON, Sales Agent.

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CINCINNATI.

A&W INK USED ON THIS PUBLICATION

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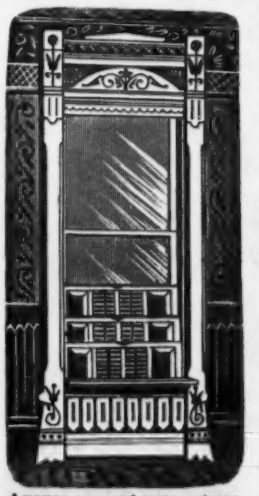

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HARTMAN & DURSTINE, No. 59 Beaver St. Wooster, O.

MACHINERY SUPPLY MARKET.

Anvils.

American.....₩ lb 9@10
Wrights.....₩ lb 12

Bellows.

Blacksmiths' { Hill's.....dis 40 / Bullock's.... dis 50&10
Moulders'.....dis 40@40&10
Hand.....dis 40&10@50

Belting.

Boston Belting Co's standard.....dis 70
" " " extra.....dis 60&5
" " " best.....dis 55
Hoyt's Short Lap.....dis 45
Cleveland Rubber Co. extra standard..dis 60&10
Shults Raw Hide Leather Belting, single, ...dis 40
Shults Raw Hide Leather Belting, double and Light Double.....dis 40
Standard, oak tanned.....dis 50&10
Alexander Brothers' pure oak tanned. ...dis 45

Blowers and Exhausters.

B. F. Sturtevant's.....dis 20
Boston Blower Co.....dis 35
Buffalo.....dis 35

Borax.

.....₩ lb 12

Chalk.

White.....₩ gross 50
White Crayon.....₩ gross 12@12½ dis 10
Red.....dis 70
Blue.....dis 85

Chucks.

Cushman's 4 Jaw Independent.....dis 45
" Combination.....dis 40
" Geared Scroll.....dis 30
" 2 Jaw Brass Workers.....dis 30
" Drill.....dis 35
Wescott's Scroll Combination.....dis 33⅓
" Independent.....dis 40
" Little Giant Drill.....dis 30
Horton's Universal.....dis 40
" Independent.....dis 45
Whiton's Independent.....dis 45
National Combination.....dis 40
Sweetland " .....dis 40
Almond Drill.....dis 20
Morse " .....dis 15
Skinner's Combination Lathe.....dis 33⅓
" Independent Lathe.....dis 40
" Universal Lathe.....dis 40
" Drill.....dis 15

Cutters and Reamers.

Cleveland.....dis 10@15
Pratt & Whitney.....dis 10@15
Standard.....dis 10@15
Brown & Sharpe, Milling Cutters.....dis 15
Gear Cutters.....dis 15

Crowbars.

Cast Steel.....₩ lb 4
Iron, steel points.....₩ lb 3½

Drill and Drill Sockets.

Twist drills.....dis 50&10
Morse Taper and Straight shank to 1¾".....dis 50&10
Morse Taper and Straight shank Larger than 1¾".....dis 25
Drill Sockets.....dis 25
Standard Twist Drills.....dis 55@55&5
Cleveland " " .....dis 55@55&5

Emery.

	No. 4 to 46 gr.	No. 54 to 150. gr.	Flour, F.	C. F. FF.
Kegs, ₩ lb	4 c	5 c		2½c
¼ kegs ₩ lb	4½c	5½c		2¾c
⅛ kegs ₩ lb	4½c	5½c		3 c
10 lb cans, 10 in case	6 c	6½c		5 c
10 lb cans, less than 10	10 c	10 c		7½c

Emery Cloth and Paper.

Barder, Adamson & Co.....dis 45@50
H. H. Barton.....dis 50@50&10

Emery Wheels.

Detroit.....dis 55@60
Norton's.....dis 55@60
Grant.....dis 55@60
Sterling.....dis 60
Celluloid.....dis 10&33⅓
Northampton.....dis 55
Crystal.....dis 65@70
Vitrified.....dis 60
Vulcanite.....dis 10&10

Files.

Nicholson.....dis 60&10@60&10&10
" X. F.....dis 25
Kearney & Foot.....dis 60&10@60&10&10
Black Diamond.....dis 60&10@60&10&10
Arcade.....dis 60&10@60&10&10
Disston's.....dis 65@70
Western.....dis 70
Stub's.....dis 25
Grobet's.....dis 30
Reynolds Bros.' Hand Cut.....dis 50
ndustry File Works, hand cut.....dis 50

Hammers.

P. S. W.....dis 40
Atha new list, Jan. 15, 1887.....dis 50
Heavy hammers and sledges under 5 lbs. 18c over 5 lbs 14c, new list.

Jack Screws.

Illinois Bolt Co. list.....dis 70

Nuts and Washers.

Size of bolt inches	¼	5-16	⅜	½	⅝	¾	1
Square	8	7	5¾	4½	4	2½	2⅛
Hexagon	15¾	11¾	8½	6	5¼	5¼	5
Washers	9	8	7	5	4½	4½	4½

In lots less than 100 lbs, ₩ lb add ½c., 1lb boxes add 1c to list.

Nails (wire.

List July 14, 1887.....dis 70 &10
Standard Penny Nails, ₩ keg card rate
{ Car lots.....$2.30
{ Less than car lots $2.40

Oilers.

Zinc and Tin.....dis 60
Brass and Copper.....dis 50
Malleable (Hammer's), No. 1, $3.60; No. 2, $4.00; No. 3, $4.40 ₩ doz.....dis 10@10&10

Packing, Steam.

Boston Belting Co.....dis 60
American Packing Hemp.....₩ lb 10@11
Russia Packing " .....₩ lb 14
Italian Packing " .....₩ lb 13@14
Plumbago Piston.....₩ lb 40
Morrison's " .....₩ lb 50
Square Flax " .....₩ lb 50
Sheet Rubber.....₩ lb 12&24
Excelsior Rubber.....₩ lb 48

Picks.

Railroads, 5 to 6 lbs.....$12 dis 60
" 6 to 7 lbs.....$13 dis 60

Pulleys.

Iron Pulleys, Walker List.....dis 45
Medart Pulleys.....dis 55
Split Wood Pulleys.....dis 50@55

Rivets.

Iron, Thousand, list November 17, ...dis 50
Iron, Ordinary, Cooper's Block and Carriage list November 17.....dis 50
Copper.....dis 50@50&10

Rope.

Manilla, ¼ inch and over.....₩ lb 15¼
Sisal, ¼ inch and over .....₩ lb 13¼

Sand Paper.

B. A. & Co.....dis 45@50
H. H. Barton's.....dis 40@45
New England Flint.....dis 40@50
Barton's Garnet.....dis 20

Saws.

Disston's Circular.....dis 40@45
" Band.....dis 30
" Scroll .....Net
Hack Saw Stubs.....dis 20
" " Eureka.....dis 20
" " Star.....dis 20
Saw Swages Disston's.....dis 30
Atkins' Cicular Saws.....dis 40&45
" Mill, Mulay and Drag Saws..dis 40&10
" Wood Saws.....dis 40&10
" Silver Steel Diamond Cross-cut Saws.....dis 70c per ft
" Dexter Cross-cuts.....dis 50c "
" Diamond " .....dis 50c "
" Tuttle Tooth Cross-cuts..dis 25c "
" One-man Cross-cuts.....dis 32c "
No. 1 Handles.....dis 25c per pair
No. 6 " .....dis 16c "
Excelsior Saw Tools.....$6 per doz
Perfection " .....$15 "
Detroit Saw Works, Circular.....dis 50
" " " Band.....dis 25
" " " Mulay.....dis 45

Screws.

Wood Screws—New List 1890.

Flat head iron.....dis 72½
Round head iron.....dis 67½
Flat head brass.....dis 72½
Round head brass.....dis 60
Square Cap.....dis 65
Hexagon Cap.....dis 60
Set C. H. C. P.....dis 70
Machine, flat head, iron.....dis 65
Machine, round head, iron.....dis 60
Bench and hand—
Lag or coach.....dis 75@75&10
Coach, patent gimlet point.....dis 75

Shovels and Spades.

Ames' list November 1, 1885.....dis 20
Dennis.....dis 5.25
Hussey & Binns, railroad.....dis 8.00

Taps.

Cards, Hand and Nut to 2 in.....dis 50
Carpenters' " " " .....dis 50
Morse " " " .....dis 50
Pratt & Whitney " " new list dis 10
Machine Screw Taps.....dis 55
Pipe Taps to 2¼ in.....dis 70
Stay Bolt Taps.....dis 25
Stove Bolt Taps.....dis 50
Pulley Taps.....dis 40

Twine.

	BC.	B.
No. 12, Flax Twine, ¼ and ⅛ lb Balls	21c@29c	
No. 18 " " ¼ and ⅛ "	18c@28c	
No. 36 " " ¼ and ⅛ "	16c@27c	
2-Ply Hemp, ¼ & ⅛ lb Balls (Spring Twine)	11¾c	
3-Ply " 1 lb Balls	12@12¼c	
3-Ply " 1¼ lb Balls	11@11¼c	
Cotton Wrapping, 5 Balls to lb	15@16c	

Vises.

Solid Box.....dis 60
Parker's.....dis 20@25
Prentiss.....dis 20
Stephen's.....dis 25@30
Barrett's.....dis 30
Miller's Falls.....dis 40
Merrill's.....dis 15@20
Howard.....dis 35

Wire.

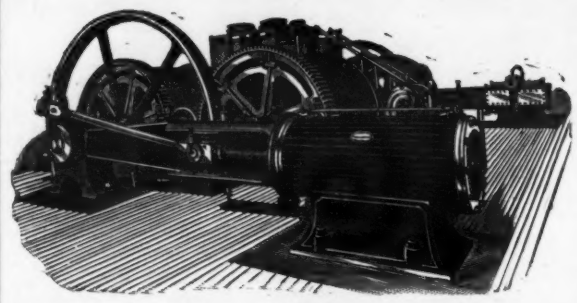
New List, Jan. 18, 1884

Brass and copper.....dis 20@25
Bright and annealed, Nos. 0@18...dis 70&10@75
" " Nos. 19@26.dis 75@75& 5
" " Nos. 27@36..dis 75&10& 5
Coppered Nos. 0 to 18, market list..dis 70@70& 5
Galvanized Nos. 0 to 18 " ".....dis 65&5
Tinned market Nos. 0 to 18.....dis 67½
Cast steel.....dis 50
Tinned Broom Wire.....dis 70&5@70&10
Annealed Fence, Nos. 8 and 9.....dis 75
Annealed Grape, Nos. 10 to 14.....dis 75
Stub's Steel Wire regular.....$6.00 lb dis 3

Wrenches.

Coe's genuine, ...dis 50
Girard Standard.....dis 70&10
Agricultural.....dis 75&10
Mechanics'.....dis 55&10,& 3
Bemis & Call's Combination .....dis 35
Donohue's Engineers.....dis 20&10
Lamson & Sessions Engineers.....dis 60
Billings & Spencer's Drop Forged.....dis 25
William's " " .....dis 25
Alligator " " .....dis 50

Webster, Camp & Lane Machine Co.



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Mining Machinery,

Improved Band Friction Hoisting Machinery, Geared or Direct Acting, for round or flat rope.

Wire Rope Haulage Machinery,

Endless or Tail Rope Systems.)

CORNISH PLUNGER AND BUCKET LIFT PUMPS.

Automatic or Slide Valve Steam Engines, Sheaves, Cages, Buckets, Etc.

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ESTABLISHED 1828.

Oldest and Largest Manufacturers In the world.

VULCANIZED RUBBER GOODS

For Mechanical purposes.

256-260 DEVONSHIRE STREET, BOSTON.

100 Chambers St., New York.
161 to 165 W. Pearl St., Cincinnati, Ohio.
148 to 150 Water St., Cleveland, Ohio
109 Madison St., Chicago, Ill.

THE THOS. D. WEST FOUNDRY, CO.

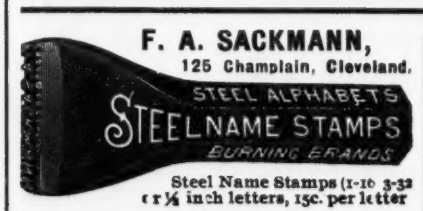
CLEVELAND, O.

LIGHT AND HEAVY

IRON CASTINGS.

DAILY MELTING CAPACITY 75 TONS—SPECIAL FACILITIES FOR ECONOMICALY TURNING OUT SMOOTH CLEAN CASTINGS.

DUPLICATE WORK A SPECIALTY



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125 Champlain, Cleveland.

Steel Name Stamps (1-16 3-32 or ¼ inch letters, 15c. per letter

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Detachable Roller and Chain Belting

CHAIN

MADE IN ALL SIZES OF

Malleable Iron and Steel,

DESIGNED FOR

Elevators, Conveyors, Drive Belts, etc.

For handling materials of all kinds.

Send for Illustrated Catalogue. Address

The Jeffrey M'f'g Co.,

183 East 1st Ave.,

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Eastlake Metallic Shingles.

Unequaled for

ROOFING AND SIDING.

Manufactured by

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Galvanized Iron Cornice Works,

Detroit, Mich.

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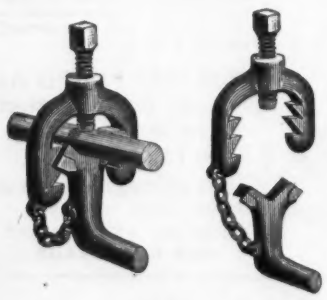

THE INDISPENSABLE LATHE DOG.

THE INDISPENSABLE LATHE DOGS can be attached to work after the work is centered in the lathe. They can be used equally as well BETWEEN COLLARS as upon plain or straight work.

DROP FORGED FROM BAR STEEL.

No. 1 takes from ¼ to 1¼ inches, price, each.....$1 50
" 2 " ½ to 2½ " " 2 50
" 3 " 1 to 3¼ " " 3 50
Price, per set of three, to take from ¼ to 3¼ in. 7 50

PALMER, CUNNINGHAM & CO., L't'd,

607 Market St., PHILADELPHIA, PA.

IRON FOUNDRY CANTON IRON FOUNDRY CO., Canton, Ohio.

HEAVY AND LIGHT CASTINGS.

Privilege to make estimates solicited.

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STEAM BOILER FURNACE IN THE WORLD.
SEND FOR DESCRIPTIVE PAMPHLET. THE BRIGHTMAN STOKER CO. 201-203 RIVER ST. CLEVELAND, OHIO.

HARDWARE MARKET.

Augers and Bits.

Common augers and bits.....dis 70
Snell's.....dis 60&5
Cook's Douglass Mfg. Co.....dis 55
Russell Jennings' augers and bits.....dis 25
Expansive Bits, Clark's small, $18; large, $26.....dis 35@35&5
Hollow Augers, Ives'.....dis 25&10
Hollow Augers, Bonney's Adjust. ℔ doz., $48.....dis 40&10
Hollow Augers, Stearns' Adjust. ℔ doz., $48.....dis 20&10
Gimlet bits, common.....per gross $3 25@4 00
Standard Bit Stock Drills.....dis 50&10&5
Ship Augers.....dis 15&10@15&10&5

Axes.

Makers' and Special Brands—
First quality.....℔ doz $8 00
Others.....℔ doz $7 00
Full polished.....℔ doz $9 00

Bolts.

Cast iron barrel bolts.....dis 70
Cast iron shutter bolts, etc.....dis 70
Cast iron chain bolts.....dis 65&10
Ives' patent door bolt.....dis 60
Wrought iron barrel bolts.....dis 70
Wrought iron square bolts.....dis 70
Wrought shutter bolts.....dis 60&10
Sargent's list
Carriage, common, new list.....dis 75&10
Tire, common, new list.....dis 65
Carriage and tire, Philadelphia pattern.....dis 75&10
Stove bolts.....dis 60
Plow bolts.....dis 60&5
Machine.....dis 75&10@80
Ends.....dis 75&10&80

Buckets, Elevator.

.....dis 50&10

Butts.

Wrought brass.....dis 75&10
Cast brass, loose joint.....dis 33⅓
Cast Iron—
Fast joint, narrow.....dis 50&10&5@60
Fast joint, broad.....dis 50&10@60
Loose joint.....dis 70&10
Loose joint, jap.....dis 70&10
Loose joint, jap. with acorns.....dis 70&10
Loose pin, acorns.....dis 70&10
Loose pin, japanned acorns.....dis 70&10
Loose pin, acorns, jap. plated tips.....dis 70&10
Wrought steel—
Wrought, fast joint, narrow.....dis 70&10
Wrought, fast joint, broad.....dis 70&10
Wrought, loose joint, broad.....dis 70&10
Table Butts, back flaps, etc.....dis 70&10
Regular inside blind.....dis 70&10
Light inside blind.....dis 70&10
Loose pin.....dis 70&10
Light loose pin.....dis 70&10

Carbonized Felt and Building Papers.

(POWERVILLE BRAND.)

	Per roll of 500 sq. feet.
Eberts Bros., Detroit.	
No. 1—Slaters'	$1.25
"A," Stringed Roofing, Light.	1.50
"B," Stringed Roofing, Medium	1.75
"C" Stringed Roofing, Heavy	2.00
Stringed, Rosin-Sized	1.00

MILCELLANEOUS.

Asphaltum, Trinidad Refined, ℔ ton.....$30.00
Asphaltum, Fine Grade, ℔.....08
Coal Tar Felt, 1 Ply, ℔.....02
Coal Tar Felt, 2 Ply, ℔ roll 108 sq ft.....1.42½
Coal Tar Felt, 3 Ply, ℔ roll 108 sq ft.....1.85
Roofing Pitch, ℔ gal.....09

Chains.

Revised List.

Trace, 6½-10-2.....℔ pair 1.03
Trace, 6½-10-3.....℔ pair .92 .....50&10
Trace, 7-10-2.....℔ pair 1.11
German Halter Chain, list June, 1887...dis 50&10
German Coil, list of June, 1887.....dis 50&10@60
Galvanized Pump Chain.....℔ 5¼@6
Jack Chain, Iron.....dis 75&10
Jack Chain, Brass.....dis 75

Chisels.

Socket Framing and Firmer.....dis 75
Socket Framing and Firmer, Buck Bros..dis 30
Socket Firmer and Framing, L. & I. J. White.....dis 30@30&5
Tanged Firmers.....dis 40&10

Cutlery.

Table.....net
Excelsior Pocket.....net

Fibre Ware—Standard.

	Nos. 1	5.	5X.
Pails, water, 12 qt	$4 00	$4 50	$.....
Dairy, 14 qt	4 50	5 00	.....
Fire 12 qt	5 00	.....	.....
Sugar	6 00	6 50	.....
Horse	.....	5 00	.....
Buggy	4 00	.....	.....
Chamber, Slop, Commode } 5 and 5X 14 qt.	6 50	7 50	8 50
2 qts. slop, 5 and 5X 14 qt	8 00	9 00	10 00
Basins—			
10½ inch	2 00	2 25	.....
12 inch	2 25	2 75	3 25
13½ inch	2 75	3 25	3 75
15 inch	3 25	3 75	4 25
Bowls, fruit	.....	2 50	.....
Servers, 12 in	.....	2 25	.....
Baskets, waste paper, 13 in	.....	6 00	.....
Spittons, "Daisy," pressed			
8 inch	4 00	4 50	5 00
10 and 11¼ inch	6 00	6 50	7 50

No. 1 plain; No. 5 decorated; No. 5X White decorated.

Gimlets.

Nail and Spike.....dis 50&10&5
Double cut, low list.....dis 25
"Bee".....℔ gross $12, dis 25@25&5

Hanger

Barn door, old patterns.....dis 60&10&10@70
Climax, (Anti-Friction).....dis 60
Scranton.....dis 33—
Kidder's.....dis 50&10@60
Terry's Patent.....5 in., $12; 4 in., $10, dis 50&5
Paragon.....dis 40&10
Richard's.....dis 30@30&10

Horse Nails.

No.	10	9	8	7	6	
Ausable, ℔ lb.	23	24	25	26	28	dis 40
Putnam, ℔ lb.	18	19	20	21	23	dis 15
Essex						dis 25&10

Horse Shoes.

Burden, at factory.....℔ keg $4 00
R. I. Horshoe Co., Perkins' Imp. at factory.....℔ keg $4 00
Mule Shoes, at factory.....℔ keg $5 00

Knobs.

Carriage, japanned.....℔ gross 80c dis 60&10
Base, rubber tip.....dis 70&10&5
Hematite door knobs, new list.....dis 40&10@50
Door mineral.....dis 65c@68c
Door Por. japanned.....dis 75c@78c
Door Por. nickle.....$2 00@2 25
Door Por. plated.....$2 00@2 25

Locks, Bolts, Etc.

P. & F. Corbin, Locks and Bronze Goods.
Door locks, knobs and latches.....dis 60&10
Escutcheons and keys.....dis 60&10
Padlocks and padlock keys.....dis 75
Bell pulls, mineral, porcelain and jet dis 60&10
Bell pulls, genuine bronze.....dis 60&10
Lever bell pulls, genuine bronze.....dis 60&10
Butts', genuine bronze.....dis 60&10
Butts' bronze plated.....dis 60&10
Store door locks and latches.....dis 60&10
Store door handles.....dis 60&10
Shutter hinges&flaps, genuine bronze.dis 60&10
Shutter hinges, bronze plated.....dis 70
Flush bolts, genuine bronze.....dis 70
Shutter knobs, genuine bronze.....dis 50
Shutter bars, genuine bronze.....dis 60
Sash lifts, genuine bronze.....dis 60
Sash pulls and plates, genuine bronze.....dis 60
Push plates, genuine bronze.....dis 60
Drawer pull, genuine bronze.....dis 70
Letter box plates, genuine bronze....dis 60&10
Barn door locks.....dis 33⅓
Bishop's Buckeye Sash Locks.....℔ gross $4.80

Plumbs and Leve s.

Standard list.....dis 70&10
Pocket levels.....dis 70&10
Davis' inclinometers.....dis 10&10

Pumps.

Cistern, best makers.....dis 50&10@60
Pitcher spout, best makers dis 60&10@60&10&10
Pitcher spout, cheaper goods.....dis 70@70&5

Pokes, Animal.

Bishop's I. X. L.....℔ doz $6 00
Bishop's O K.....℔ doz $5 25
Bishop's Pioneer.....℔ doz $3 75
Bishop's American.....℔ doz $2 75

Rakes.

Cast steel.....dis 70
Malleable.....dis 70@70&5

Razors.

J. R. Torrey Razor Co.....dis 20
Wostenholme & Butcher.....$10@$4...dis 10
Rifle razor.....dis $9 50 net

Rat Killers.

Schuyler's.....℔ gross $15 00

Scales.

Hatch, Counter, No. 171.....℔ doz $21 00
Hatch, Tea, No. 161.....℔ doz $6 75@7 00
Chatillon's Grocers'.....dis 50
Family Turnbulls.....dis 30@30&10
Scale Beams, List of January 12, 1882.....dis 50&10@50&10&4

Screw Drivers.

Stanley R. & L. Co.'s Varnished Handles.....dis 65&10
Stanley R. & L. Co.'s Black Handles..dis 60&10
Sets interchangeables.....℔ doz $18 dis 25

Squares.

Steel and iron, Nickel plated } dis 75&10@80
Disston's try square and T bevels.....dis 45&10
Winterbottom's try and miter.....dis 30&10

Tacks, Brads, Etc.

New List, Oct. 19, 1890.

American iron carpet tacks all kinds dis 77½&10
Steel carpet tacks all kinds.....dis 75&10
Swedes iron carpet tacks, all kinds dis 75&10
Swedes iron tacks.....dis 75&10
Swedes iron Upholsterers' tacks.....dis 75&10
Tinned Swedes iron tacks.....dis 77½&10
Tinned Swedes iron Upholsterers' tacks.....dis 77½&10
American iron cut tacks.....dis 77½&10
Copper tacks.....dis 40&10
Copper finishing and trunk nails.....dis 50&10
Cigar box nails.....dis 50&10
Finishing nails.....dis 60&10
Hungarian nails and miners' tacks...dis 60&10
Gimp and lace tacks.....dis 77½&10
" " " tinned.....dis 60&10
Trunk and clout nails.....dis 72½&10
Tinned trunk&clout nails.....dis 66&10
Basket nails.....dis 66&10
Chair nails.....dis 66&10
Common and patent brads.....dis 66&10

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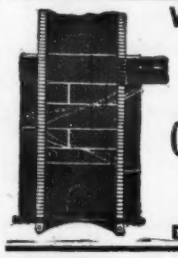

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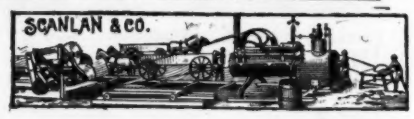

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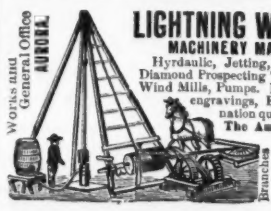

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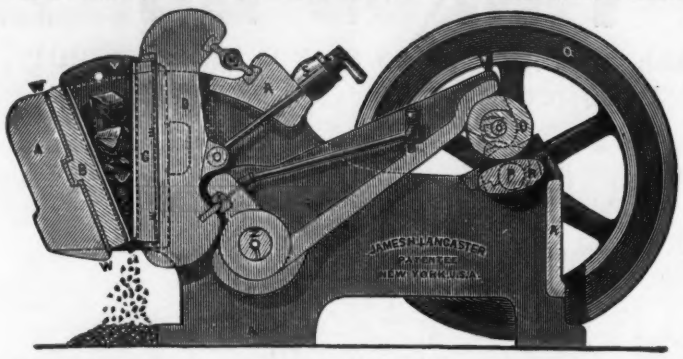

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Will automatically dig, raise and discharge mud, clay, gravel, sand, hard pan ores, rock phosphates and fire-clay from their beds and banks, and also load and unload vessels or barges with sand, coal, ores, grain and other materials. These Grapples are made of best forged steel, with four penetrating scoops, operated solely by compound leverage, thus dispensing with the inside sheaves, drums, catches, gears, chains and friction, found in all rival buckets. They may be worked by the "Lancaster" hand or horse-power, hoisters, or by any maker's double drum hoisting engines.

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Self-Penetrating Grapple, Excavator AND Dredger.

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Through Sleepers Between
PITTSBURGH AND CHICAGO.
AND DAY COACHES BETWEEN
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Standard Time.

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	Arrive.	Depart.
N. Y. & Pitts. Express.....	‡5 38 a m	*8 25 a m
Fast N. Y. & Pitts. Express	*10 55 a m	*3 00 p m
Mahoning Accommo.....		†6 40 a m
Pittsburgh Express.....	†6 25 p m	
Youngstown Local.....	†8 05 a m	
Mahon'g div. & Pitts Local		*11 40 a m
Mahoning Val. Accom.....		†4 30 p m
Pittsburgh Express.....	‡1 20 p m	11 10 p m
New York Express.....	*8 00 p m	.....

*Daily. †Daily, except Sunday. ‡Daily except Monday.

Cleveland & Canton Railroad.
(Standard Gauge.)

Depart for—
Zanesville and Coshocton—6:50 a. m., 3:00 p. m.
Canton—6:50 a. m., 3:00 p. m., 6:20 p. m.
Kent—6:50 a. m., 3:00 p. m., *5:45 p. m. 6:20 p. m.
Bedford—6:50 a. m., 11:10 a. m., 1:30 p. m., 3:00 p. m., 4:40 p. m., *5:45 p. m., 6:20 p. m. 10:35 p. m.
Newburgh—6:15 a. m., 6:50 a. m., 11:10 a. m., 1.30 p. m., 3:00 p. m., 4:40 p. m., *5:45 p. m., 6:20 p. m., 10:35 p. m.

Arrive from—
Zanesville and Coshocton—10:30 a. m.,6:30 p. m.
Canton, 10:30 a. m., 2:35 p. m., 6:30 p. m.
Kent—*8:10 a. m., 10:30 a. m., 2:35 p. m., 6:30 p.m.
Bedford—6:00 a. m., *8:10 a.m., 10:30 a.m., 1:05 p. m., 2:35 p. m., 4:15 p. m., 6:30 p.m., 7:10 p.m.
Newburgh—6:00 a. m., 7:15 a. m., *8:10 a. m., 10:30 a. m., 1.05 p. m., 2:35 p. m., 4:15 p. m., 6:30 p. m., 7:10 p. m.
Trains marked * run daily.

Valley Railway.
FOR AKRON, CANTON AND MARIETTA.
Depot oot South Water Street.

	Depart.	Arrive.
Valley Junction Mail.....	*7 25 a m	*6 40 p m
Marietta Express.....	†11 15 a m	†2 35 p m
Balto. & Wash. Express....	*4 00 p m	*10 25 a m
Cleve. and Canton Express	†6 30 p m	†8 15 a m

*Daily. †Daily, except Sunday.

J. T. JOHNSON, Gen. Supt. J. B. CAVEN, Gen. Pass. Agt

From Cleveland Union Station.

PENNSYLVANIA LINES.

Cleveland & Pittsburgh R. R.

	Depart.	Arrive.
For Pittsburgh, Baltimore, Washington, Philadelphia and New York.	7 45 a m	d5 25 a m
	1 15 p m	12 50 p m
	d11 10 p m	6 35 p m
Wheeling and Bellaire.	7 45 a m	12 50 p m
	1 15 p m	6 35 p m
	*11 10 p m	.....
Alliance Accom.....	3 25 p m	10 10 a m
Ravenna Accom.....	5 00 p m	8 25 a m

d Daily. * Except Saturday. Other trains except Sunday.

From Cleveland Union Station.

Mt Vernon and Pan Handle Route

Cleveland & Pittsburgh R. R.

	Depart.	Arrive.
For Cuyahoga Falls, Akron, Orrville, Millersburg, Gambier, Mt. Vernon, Columbus, Xenia, Dayton, Cincinnati, Louisville, Indianapolis, St. Louis, and all points in the South and Southwest.	8 00 a m	d 7 00 am
	d 8 00 p m	5 40 p m
For Cuyahoga Falls, Akron, Orrville, Millersburg, Gambier, Mt. Vernon and Columbus.	1 15 p m	12 50 p m
For Cuyahoga Falls, Akron, Orrville, Chicago, and all points in the West and Northwest.	8 00 a m	5 40 p m
	3 25 p m	10 10 a m

d Daily. Other trains except Sunday.
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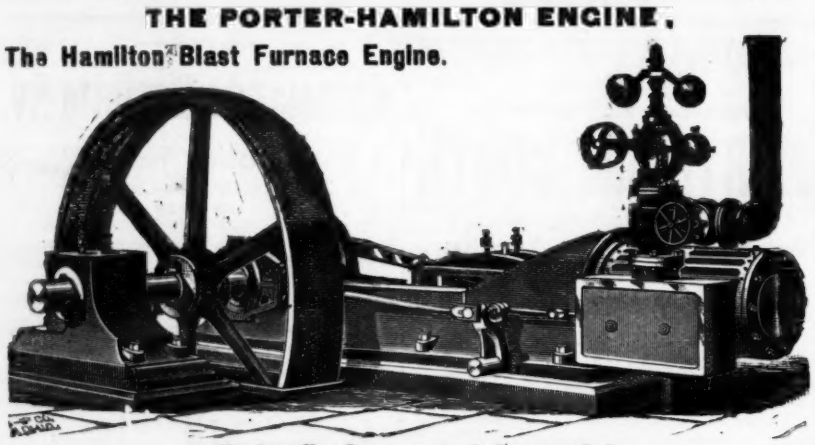

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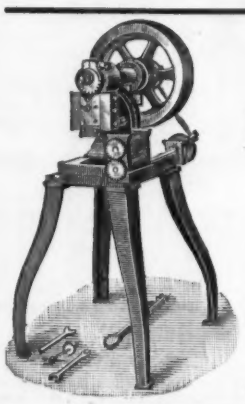

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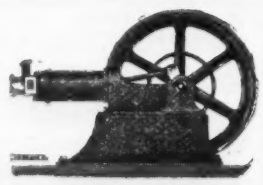

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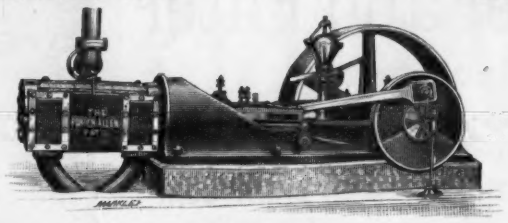

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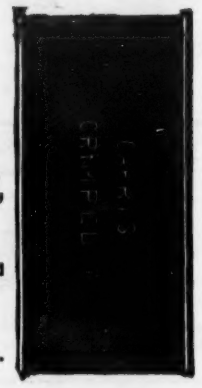

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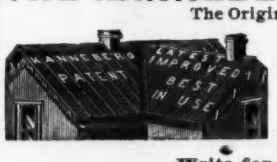

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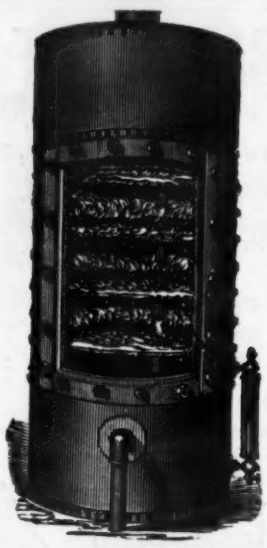

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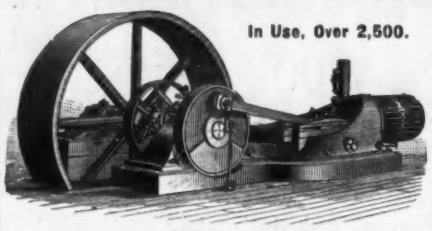

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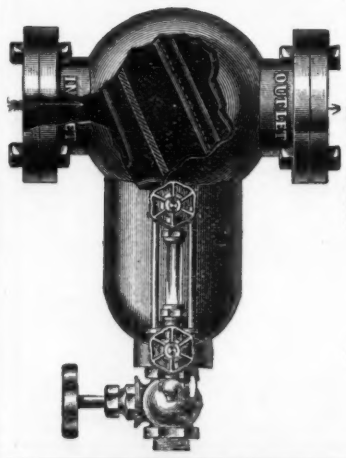

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